Food and Agriculture Organization of the United Nations

CIFOR

Mainstreaming biodiversity in forestry

Country case studies

CGIAR RESEARCH PROGRAM ON Forests, Trees and Agroforestry

FAO FORESTRY PAPER

188 Suppl. 1

ISSN 0258-6150

SHOUT
SHARE
IT

Mainstreaming biodiversity in forestry

FAO
FORESTRY
PAPER

188 Suppl.1

Country case studies

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2024

Required citation:

Harrison, R.D. & Cheptow-Lusty, A.J., eds. 2024. *Mainstreaming biodiversity in forestry – Country case studies*. FAO Forestry Paper No. 188 Suppl. 1. Rome, FAO. https://doi.org/10.4060/cc4906en

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

ISSN 0258-6150 [print]

ISSN 2706-8773 [online]

ISBN 978-92-5-137735-2

© FAO, 2024

Some rights reserved. This work is made available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; https://creativecommons.org/licenses/by-nc-sa/3.0/igo/legalcode).

Under the terms of this licence, this work may be copied, redistributed and adapted for non-commercial purposes, provided that the work is appropriately cited. In any use of this work, there should be no suggestion that FAO endorses any specific organization, products or services. The use of the FAO logo is not permitted. If the work is adapted, then it must be licensed under the same or equivalent Creative Commons licence. If a translation of this work is created, it must include the following disclaimer along with the required citation: "This translation was not created by the Food and Agriculture Organization of the United Nations (FAO). FAO is not responsible for the content or accuracy of this translation. The original [Language] edition shall be the authoritative edition."

Disputes arising under the licence that cannot be settled amicably will be resolved by mediation and arbitration as described in Article 8 of the licence except as otherwise provided herein. The applicable mediation rules will be the mediation rules of the World Intellectual Property Organization http://www.wipo.int/amc/en/mediation/rules and any arbitration will be conducted in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

Third-party materials. Users wishing to reuse material from this work that is attributed to a third party, such as tables, figures or images, are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

Sales, rights and licensing. FAO information products are available on the FAO website (www.fao.org/publications) and can be purchased through publications-sales@fao.org. Requests for commercial use should be submitted via: www.fao.org/contact-us/licence-request. Queries regarding rights and licensing should be submitted to: copyright@fao.org.

Cover photograph: Primary tropical rainforest in Kalimantan, Indonesia. ©FAO/Ken Shono

Preparation of this document

This supplementary material comprises country case studies commissioned as part of an assessment on biodiversity mainstreaming in forestry conducted by FAO and the Center for International Forestry Research (CIFOR).

Contents

1. Democratic Republic of the Congo **1**
1.1. Context 1
1.2. Policy and law pertaining to biodiversity conservation 2
1.3. Indigenous Peoples and local communities and their rights 4
1.4. Institutional conflicts 6
1.5. Biodiversity management in different types of forests 6
1.6. Conclusions and lessons learned 10

2. Ethiopia **13**
2.1. Context 13
2.2. Biodiversity and forest policy framework 15
2.3. Biodiversity and forest policy in practice 21
2.4. Institutional arrangements and forest biodiversity 24
2.5. A practical example of forest biodiversity management 25
2.6. Conclusions and lessons learned 26

3. Finland **28**
3.1. Context 28
3.2. Biodiversity policy, forest policy and regulations 32
3.3. Forest biodiversity and climate change 38
3.4. Indigenous Peoples, forests and biodiversity management 38
3.5. Institutional arrangements for biodiversity and forestry 39
3.6. Experiences of biodiversity management in forests 40
3.7. Reflections on biodiversity management in Finnish forests 41
3.8. Main findings and lessons learned 42

4. Japan **44**
4.1. Context 44
4.2. Government-designated areas to conserve biodiversity and ecosystem services 45
4.3. Other strategies for promoting biodiversity conservation and ecosystem services 47
4.4. Examples of mainstreaming biodiversity conservation in managed forests 51
4.5. Conclusions and lessons learned 53

5. Malaysia **55**
5.1. Context 55
5.2. Policy and legal context 58
5.3. Institutional arrangements 60
5.4. Timber concessions 62
5.5. Restoration/reforestation projects 64
5.6. Indigenous Peoples 66
5.7. Community forests 67
5.8. Conclusions and lessons learned 68

6. Mexico **71**
6.1. Context 71
6.2. Institutional framework 74
6.3. Legal and regulatory framework 75
6.4. Policy framework 77
6.5. Economic incentives 78
6.6. Monitoring 80
6.7. Information generation and dissemination 80
6.8. Experiences of biodiversity management in forests 81
6.9. Conclusions and lessons learned 87

7. Peru **90**
7.1. Context 90
7.2. Biodiversity policy and forest policy and regulations 92
7.3. Role of Indigenous Peoples and local communities in forest biodiversity management 98
7.4. Institutional arrangements 99
7.5. Experience of forest biodiversity management in Peru 101
7.6. Lessons learned 105

8. United Kingdom of Great Britain and Northern Ireland (Scotland) **108**
8.1. Context 108
8.2. Forest policy and regulations 108
8.3. Institutional arrangements 114
8.4. Experience of biodiversity management 115
8.5. Synthesis and lessons learned 124

9. References **127**

1. Democratic Republic of the Congo

Marie-Bernard Dhedya Lonu

Science and Sustainable Development Laboratory, University of Kisangani, Kisangani, Democratic Republic of the Congo

1.1. CONTEXT

The Democratic Republic of the Congo has a total area of 2 345 409 km^2, with 155.5 million ha of forest (67 percent of the national territory), a hydrographic network composed of three major basins, namely the Congo River, Shiloango River and Nile River, an important fisheries potential and is among one of the richest countries in terms of its biodiversity. It has a fauna composed of 352 species of reptiles (including 33 endemic species), 168 species of amphibians, 1 086 species of birds (including 23 endemic species), 421 species of mammals of which 28 are endemic, and more than a thousand species of fish (PNEFEB, 2013). Notable species include gorillas (*Gorilla beringei graueri* and *Gorilla beringei beringei*), bonobo (*Pan paniscus*), chimpanzees (*Pan troglodytes schweinfurthii*), elephant (*Loxondonta africana africana* and *Loxondonta africana cyclotis*), okapi (*Okapia johnstoni*), giraffe (*Girafa camelopardalis*), manatee (*Trichechus senegalensis*), northern white rhinoceros (*Ceratotherium simum cottoni*, which has not been recorded since 2006 and may be locally extinct), cheetah (*Acinonyx jubatus*), marine turtles (Chelonioidea), including the olive ridley turtle (*Lepidochelys olivacea*), blind fish (a diverse group recently discovered living in extreme conditions of the lower Congo river), Congo peafowl (*Afropavo congensis*), numerous species of birds of prey and water birds, and a multitude of other species representative of the Congo Basin ecosystems (PNEFEB, 2013; IUCN, 2001). As for flora, there are about 377 families, 2 196 genera and 10 324 plant species. The forests of the Congo Basin constitute the second largest tropical forest in the world, after the Amazon, and the Democratic Republic of the Congo alone represents about 60 percent of this forest. As such, the Democratic Republic of the Congo accounts for about 10 percent of the world's forests and 50 percent of those in Africa (de Wasseige *et al*., 2009).

Of the total forest cover of the Democratic Republic of the Congo, only 11.3 percent or 26 415 737 ha is within protected areas (PAs), the rest comprising other types of forest, including permanent production forests, among others (Doumenge *et al*., 2015; Atlas forestier de la RDC, 2021). In addition, nearly 80 percent of the Congolese population lives in rural areas (Dhedya Lonu, 2018) and derives most of its livelihood from forests, thus generating considerable anthropogenic pressure

on forest resources. Furthermore, the rights of local communities and especially Indigenous Peoples are not sufficiently respected, which can cause conflicts over forest use (Nasi, Taber and Vliet, 2011; de Wasseige *et al*., 2014, 2015). The management of production forests and agricultural concessions remains mixed and very few community forests have been established to date. The degradation of biodiversity is becoming worrisome due in large part to the lack of consideration for forests outside PAs.

The Democratic Republic of the Congo put in place a strategy to enable better protection of its biodiversity that essentially consisted of creating PAs. The objective of this strategy was to devote 17 percent of the Democratic Republic of the Congo's forest potential to PAs, which were placed under the management of the Directorate of Nature Conservation of the Ministry of the Environment. However, this policy did not sufficiently take into account the Indigenous Peoples and local communities (IPLCs) who live in and depend on these forests.

1.2. POLICY AND LAW PERTAINING TO BIODIVERSITY CONSERVATION

In general, there remains much to do in the Democratic Republic of the Congo in terms of integrating biodiversity across all the sectors (forestry, mining, land, hydrocarbons, etc.) that affect it. It should be noted, however, that some laws take biodiversity management into account.

- The constitution sets out the fundamental principles that should guide the management of biodiversity.
- Law No. 011/2002 of 29 August 2002 on the Forestry Code was developed with financial support from UNDP and the World Bank, as well as technical support from FAO in collaboration with the Democratic Republic of the Congo government. With its 156 articles subdivided into 10 titles, and 13 regulatory provisions for its implementation, this law essentially relates to the management of floral biodiversity.
- Decree No. 14/018 of 2 August 2014 sets out the modalities for the allocation of forest concessions to local communities.
- Ministerial Order No. 025/CAB/MIN/ECN-DD/CJ/00/RBM/2016 of 9 February 2016 on specific provisions related to the management and exploitation of forest concessions by local communities.
- Law No. 014-003 of 11 February 2014 on nature conservation was adopted to replace the Ordinance-Law No. 69-041 of 22 August 1969, the implementation of which proved difficult due to the lack of enforcement measures and its unsuitability for the development and poverty alleviation needs of local communities. This law contains 86 articles divided into 6 titles that set out the rules for the conservation of biological diversity, the sustainable use of its components, and the access to and fair and equitable sharing of the benefits arising from the exploitation of biological and genetic resources. It contributes to the conservation of ecosystems and natural habitats, the protection of wildlife and the sustainable development of protected areas.

- Ordinance-law No. 68/074 of 8 March 1968 relating to the protection of crocodiles and modifying the legislation on hunting and fishing.
- Law No. 82-002 of 28 May 1982 regulating hunting and decree No. 014/CAB/MIN/ENV/2004 of 29 April 2004 on its implementation measures which regulates the exercise, areas, instruments and periods of hunting. It prohibits the hunting of totally protected animals and proposes restrictions on the hunting of partially protected animals.
- The decree of 21 April 1937 concerning hunting and fishing as modified by the decree of 17 January 1957.
- Law No. 11/009 of 9 July 2011 on the fundamental principles of environmental protection aims: to define the main guidelines for environmental protection; to guide the management of the Democratic Republic of the Congo's natural resource potential with a view to sustainable development for the benefit of its population; to prevent risks and combat all forms of pollution and nuisance; and to serve as a basis for specific legislation governing the conduct of sectors whose direct or indirect impacts are undeniable. This law also aims to improve the quality of life of the population, while respecting the ecological balance.

In addition to the laws, decrees and orders, the Democratic Republic of the Congo has some national strategies and policies that support biodiversity management. These include the National Strategy for Biodiversity Conservation in the Protected Areas (2012), the National Strategy for Community Forestry (2018), and the Strategy and Support Plan for Indigenous Conservation Areas (APACs, 2021–2025), which is in the final stages of development.

However, the legal, regulatory and strategic framework described above suffers from some shortcomings. Indeed, the Forestry Code, the Law on nature conservation and the Law on fundamental principles relating to the environment lack several implementation measures and their application is poorly monitored in the field. In addition, the 1937 Law on hunting and fishing is out of date and does not take into account the new requirements for the conservation of aquatic biodiversity, new fishing techniques, endemic species, threatened species and protected species. Finally, although this legal, regulatory and policy framework seeks to address biodiversity comprehensively, it does so only weakly in relation to biodiversity as a whole. As such, it focuses on the management of plant and animal biodiversity and on biodiversity located in PAs.

In recent years, the Democratic Republic of the Congo has become aware of the need to manage biodiversity in forests outside protected areas. To do this, it considered other types of forests as new themes for biodiversity management. Thus, it has recently put in place mechanisms for biodiversity management outside of protected areas in collaboration with IPLCs (e.g. identification of areas of indigenous and community heritage, Development of the Strategy and Support Plan for Indigenous Areas (APACs, 2021–2025), support for Indigenous Peoples in biodiversity protection mechanisms, support for communities in designing projects and seeking funding for sustainable management of biodiversity).

It should also be noted that in other sectors that have an impact on the environment and biodiversity (mining, extraction of hydrocarbons, etc.), the issue of biodiversity is only integrated through the requirement to carry out environmental impact assessments (EIAs) for the implementation and establishment of these activities.

1.3. INDIGENOUS PEOPLES AND LOCAL COMMUNITIES AND THEIR RIGHTS

In the Democratic Republic of the Congo, a local community is understood to be a population traditionally organized on the basis of customs and united by clan ties or parental solidarity that underpin its internal cohesion. A local community is also characterized by its attachment to a specific area. Within this larger group, there is another category that is often marginalized, i.e. the Indigenous Peoples.

The Democratic Republic of the Congo's Indigenous Peoples constitute a complex mosaic of related ethnic groups. The existing definitions and figures are neither precise nor consistent with each other. According to rough estimates from the work of Indigenous Peoples' organizations, there are currently about 600 000 Indigenous Peoples in the Democratic Republic of the Congo, spread across 25 provinces, with the exception of Central Kongo (Strategy and support plan for indigenous areas in DRC, 2021). Bahuchet (1999) estimates there are approximately 70 000 to 100 000 people who identify themselves as indigenous hunter-gatherers or their descendants, while other sources give even higher estimates.

Indigenous Peoples and local communities have rights that are recognized by the Democratic Republic of the Congo's constitution and laws. The constitution establishes the principle that there should be no discrimination among the population in access to education, functions, resources and other matters because of religion, origin, family, social conditions, residence, ethnicity, tribe, cultural or linguistic affinity. The land rights of IPLCs are partially guaranteed by the Land Law (1973) in Articles 388 and 389. These articles enshrine land rights acquired according to custom. However, they do not sufficiently guarantee the land rights of IPLCs because Article 389 provides that these customary land rights must be specified by a presidential order, which has never been issued. Also, the last provision of the legal definition of local communities, which states "it is also characterized by its attachment to a specific land area", prevents the protection of some Indigenous Peoples' land rights, as they are semi-nomadic.

It should be noted that in the customary law in force in all the territories where they are settled, Indigenous Peoples are not considered as customary owners of land or natural resources in the Democratic Republic of the Congo. In an unknown chronology, they gradually lost their ancient rights as they were driven further into the forest or integrated into the Bantu, Sudanese and Nilotic societies that invaded them. Their forests and lands were gradually subjected to the same process of customary appropriation and demarcation of territory for the benefit of their invaders (APAC Strategy and Action Plan, 2021).

The same is true of forest rights. First of all, it should be noted that the Forest Code makes no distinction between customary use rights and customary property rights (Articles 36 to 40 of the Forest Code), a distinction that is necessary because

customs claim ownership of forests, while the State claims to be the sole owner and exercises its sovereignty over them. The Forest Code recognizes the possibility for communities living in or near forests to enjoy forest resources for food, medicines and handicrafts (Articles 37, 38, 39 and 41). In addition, it recognizes, together with the community forestry law, the possibility for local communities to apply for a forest concession for some or all of the forests protected under customary law. However, this provision implicitly excludes any allocation of community forest concessions to Indigenous Peoples, since they do not regularly own any forest under customary law. Nevertheless, some enforcement measures of the Forest Code attempt to correct this inequality by including indigenous Pygmy peoples in participatory consultations prior to the allocation of any forest rights, including the allocation of forest concessions and the creation of PAs, and by recognizing Indigenous Peoples' rights to use natural resources (APAC Strategy and Action Plan, 2021). Nonetheless, some initiatives aimed at guaranteeing and promoting Indigenous Peoples' forest use rights are worth noting. These are:

- other effective conservation measures by area;
- areas and territories of indigenous and community heritage/living spaces (APAC Strategy and Action Plan, 2021); and
- the law on APACs that is currently being promulgated (it has already been adopted by the Parliament) and has the merit of including rules on land ownership by Indigenous Peoples.

Although the law on APACS contributes to guaranteeing the rights of local communities over forest resources, issues remain with community forestry in the Democratic Republic of the Congo. In its current state, the legislation on community forestry does not allow local communities, without financial, institutional, and legal support, to create community forests, which raises the risk of corruption and capture by elites (RFUK, 2014a, 2014b). In addition, it is worth noting that the legislation on nature conservation is in line with the principles of the Nagoya Protocol by guaranteeing equitable access to biological and genetic resources and payments for the traditional knowledge associated with them. However, this guarantee is not effective in terms of payments for traditional knowledge, because of the absence of any implementing legislation. To be effective, these regulations must, for example, specify the modalities for collecting payments due to the communities holding the knowledge, methods for assessing prices to be paid, the methods of payment and so on.

With regard to animal resources, Law No. 82-002 of 28 May 1982 on the regulation of hunting and Order No. 014/CAB/MIN/ENV/2004 of 29 April 2004 on its implementation measures do not allow IPLCs to benefit from this resource. Indeed, the methods, means and tools of hunting that IPLCs generally use are prohibited by these texts. In addition, they make hunting conditional on obtaining a hunting permit, which is unrealistic for communities that practice hunting as a survival activity. Similarly, the law on fishing does not strengthen the access of IPLCs to aquatic resources because it is outdated, being from the colonial period, when the rights of indigenous communities were not specifically protected. Unfortunately,

IPLCs who depend on the forest and its resources continue to live in great legal insecurity.

1.4. INSTITUTIONAL CONFLICTS

In the Democratic Republic of the Congo, biodiversity management is essentially the responsibility of the Ministry of the Environment and Sustainable Development. This management sometimes gives rise to institutional conflicts, which can be divided into two levels. The first is within the Ministry. As such, there are sometimes contradictions and conflicts between departments that claim the same responsibilities, for example, in the case of the Directorate of Forest Management and the Directorate of Inventory and Forest Management, which were both created by Ministerial Order No. 016/ME/MIN-FP/2017 of 4 August 2017 on the provisional approval of the General Secretariat for the Environment and Sustainable Development. In the field, in the implementation of their different missions, they claim the same authority to issue authorizations and allocations of forest concessions to communities. Second, there are also inter-ministerial conflicts between the ministries responsible for mines, forests, hydrocarbons, land tenure and land use planning. These conflicts are essentially related to the management of resources and the allocation of space. In practice, the same area may be the subject of several titles under different ministries, which poses a serious issue for biodiversity management, especially when these titles are issued for the purpose of resource exploitation (Dhedya Lonu, 2018).

For intra-ministerial conflicts, the General Secretariat for the Environment and Sustainable Development may succeed in harmonizing disputes, but for inter-ministerial conflicts, there is a glaring lack of any inter-ministerial framework for coordination and harmonization of disputes. This results in government policy that lacks foresight and is hampered in planning for better management of biodiversity.

1.5. BIODIVERSITY MANAGEMENT IN DIFFERENT TYPES OF FORESTS

Community forests

The Congolese community forestry model allows communities to have up to 50 000 ha of community forests in perpetuity (CIFOR, 2020). It incorporates the concept of biodiversity management and is considered an important tool of the forestry sector to leverage the country's forest ecosystems for the economic growth of the nation and for local communities (SNFC, 2018). Indeed, in recent years, community forest management has been increasingly recognized as having the potential to reduce deforestation and improve the livelihoods of rural communities that are totally dependent on forests for their survival. Thus, community forestry has been enshrined in legislation of the Democratic Republic of the Congo since February 2016. This legislative consecration and subsequent regulatory and institutional makeover of community forestry is a response to the country's international and sub-regional commitments.

There are ten international legal instruments that commit the Democratic Republic of the Congo to recognize the rights of IPLCs and to provide them with

the legal security necessary to preserve their livelihoods, including the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), Agenda 21, United Nations Declaration on Forests, African Charter on Human and Peoples' Rights, International Covenant on Civil and Political Rights, International Covenant on Economic, Social and Cultural Rights, International Convention on the Elimination of All Forms of Racial Discrimination, FAO Voluntary Guidelines, and United Nations Declaration on the Rights of Indigenous Peoples. In addition, there are two regional instruments that justify the Democratic Republic of the Congo's commitment to community forestry. The Yaoundé Declaration on Forests (1999)[1] commits member states to strengthen actions aimed at increasing the active participation of rural populations in the planning and sustainable management of forest ecosystems in the Congo Basin. Meanwhile, the Central Africa Forests Commission (COMIFAC)[2] directives, especially the Convergence Plan 2[3] adopted for the period 2015–2025 enshrines the issue of community forestry in the priority intervention axis 5 related to socioeconomic development and multi-stakeholder participation in the management and sustainable development of forest resources. This plan recommends that the different Central African states put in place, update or make operational mechanisms that promote forest management by IPLCs, as well as decentralized authorities.

In the Democratic Republic of the Congo, community forestry is organized at the political, legal and institutional levels. The second version of the Growth and Poverty Reduction Strategy Paper, known as the Second Generation, which covered the period 2011–2015, provided for the forestry and agricultural sectors to be highlighted as growth sectors, especially for rural communities (IMF, 2013). This was supported by the Priority Agenda for the revival of the forestry sector, which emphasized the need for rural forestry, action research aimed at innovative approaches for community forestry and forestry microenterprises, and the involvement of communities in reducing deforestation (MECNEF, 2003; Debroux *et al*., 2007). Institutionally, the rights of IPLCs are recognized in various laws and decrees and managed through the Multi-Stakeholder Roundtable on Community Forestry,[4] the members of which include IPLCs, provincial and local regulatory authorities designated to examine community forest applications, women and youth and other vulnerable and marginalized groups, civil society organizations, donors and other technical and financial partners, and private sector companies.

The legal, regulatory and institutional framework put in place to supervise community forestry has so far allowed the implementation of 70 community forests and has some merits.

- It makes it possible to formalize forestry operations and improve the management of rural areas.

1 https://wwfeu.awsassets.panda.org/downloads/yaounde_declaration__french_.pdf
2 https://whc.unesco.org/en/comifac
3 https://mail.comifac.org/images/documents/Plan%20de%20convrgence%202_2015-2025_Fr.pdf
4 www.rainforestfoundationuk.org/media.ashx/communique-final-8eme-trmafc.pdf

- It rests on customary use of forests requested by the local community.
- It places custom and traditional systems in the political, legal, administrative and the territorial governance of the country.
- It recognizes the multi-use character of community forests.
- It aims at the development of IPLCs, thus fighting against poverty.
- It allows the valorization of local resources through income generating activities and can limit the rural exodus in the long term.
- It allows for the implementation of other processes, such as the REDD+.
- It opens the way for experimentation of new approaches, such as community conservation and the exploitation of new markets related to payments for ecosystem services (PES).

On the other hand, community forestry has some challenges, including:

- the low legal involvement of Indigenous Peoples.
- the high cost of the process for obtaining a community forest license, i.e. up to USD 150 000 (CIFOR, 2020).
- low management capacity of IPLCs.
- weak monitoring of implementation and enforcement by the forest administration.
- lack of estimates on the financial returns of the economic models that communities plan to adopt.

In short, community forestry in the Democratic Republic of the Congo integrates biodiversity management through community conservation and the exploitation of opportunities offered by new markets related to PES. However, this integration remains weak in the current context of community forestry in the Democratic Republic of the Congo, because managing does not always mean conserving in the long term.

Forest plantations

Biodiversity management is hardly taken into account in the Democratic Republic of the Congo's forest plantations. Indeed, forest plantation management focuses more on the integration of certain exotic species, mainly *Eucalyptus* and *Acacia*. However, the use of exotic fast-growing species is sometimes promoted as a means to reduce deforestation through the sustainable production of woodfuel. This is the case of the WWF Goma projects[5], the Ibi Batéké Degraded Savanna Afforestation Project[6], and private initiatives supported by GIZ in Bukavu and Acacia plantations in Yangambi initiated by CIFOR[7].

Forest concessions

In the Democratic Republic of the Congo, forest concessions can be obtained for

[5] www.worldwildlife.org/magazine/issues/summer-2019/articles/these-handmade-cook-stoves-save-fuel-and-help-save-gorillas

[6] www.biocarbonfund.org/node/66

[7] www.cifor.org/annualreport2019/planted-trees-bring-renewed-energy-to-the-yangambi-landscapes

timber exploitation, conservation, tourism and hunting, or biodiversity use.

In logging concessions, biodiversity management is taken into account insofar as the Forest Code requires the concessionaire to develop a management plan for logging. It also requires that timber exploitation be subject to the provisions under the law on nature protection, hunting and fishing. Finally, it makes the exploitation of fuelwood and charcoal subject to compliance with the requirements of sustainable forest management (SFM). However, as far as certification is concerned, the Democratic Republic of the Congo still has a lot of work to do. While the Congo, Cameroon and Gabon are commended for the growing number of Forest Stewardship Council (FSC)-certified concessions and plantations, the Democratic Republic of the Congo has only one FSC-certified concession to date. Out of an estimated 10 762 055 ha of forest allocated as forest concessions to some fifty concessionaires, only 775 713 ha are actively managed and only La Compagnie Forestière de Transformation obtained its Legal Source TM certificate in May 2019 for its management and logging activities. There are several reasons for the failure of FSC certification in the Democratic Republic of the Congo. The first obstacle is its essentially voluntary nature. As such, there is no national policy to encourage FSC certification and the forestry administration does not support concessionaires in the FSC certification process. The absence of constraints allows forest concessionaires to have a great deal of room for manoeuvre, and they are often criticized by environmental protection, research and development organizations or UN agencies (Rainforest Foundation, CIFOR, GIZ, FAO, among others) for their environmental destruction or for abusing the rights of IPLCs. These companies sometimes face constraints in Western markets, where individuals often require certification, so they are increasingly turning to Asian markets which are less demanding.

Conservation concessions are best suited to the protection of biodiversity. This provision allows for the implementation of ecosystem service-based projects (REDD+, PES, etc.). However, to date only two PES initiatives have been implemented. The first is the PIREDD Plateaux project[8] supported by the Forest Investment Program (World Bank)[9] in the forestry and agriculture sector, which provides a payment of USD 5/ha to the Local Development Committee, with 20 percent of the amount going to the local chiefs and the remaining 80 percent being allocated to community development micro-projects. The second initiative is the Luki Reserve project (Bas-Congo) implemented by WWF with funding from the Congo Basin Forest Fund[10] in the natural regeneration sector, which also provided a payment of USD 5/ha for protected savanna. However, unlike the first initiative, this represented only one component of a multi-activity project. In general, these commendable initiatives were criticized for the small size of the payments, which undermined sustainability and meant undesirable practices could resume at the end of the projects. On the other

[8] www.wrm.org.uy/15-years-of-redd-PIREDD-Plateaux-REDD-Project-DRC-Conflicts-Complaint-Mechanism

[9] https://wwf.panda.org/?333754/MA-NDOMBE--Remarkable-achievements-with-the-Integrated-REDD-project---PIREDD

[10] www.afdb.org/en/topics-and-sectors/initiatives-partnerships/congo-basin-forest-fund/climate-change

hand, the REDD+ situation is not as mixed. The Democratic Republic of the Congo has six geographically integrated REDD+ projects implemented in five provinces with little criticism. As such, REDD+ remains one of the few PES initiatives that has significantly contributed to biodiversity conservation in the Democratic Republic of the Congo.

Although provided for in the Forest Code, no concessions relating to conservation or the sustainable use of biodiversity have been implemented in the Democratic Republic of the Congo.

Hunting grounds

The hunting estates were set up in order to make game species available to local hunters or those hunters willing to come from afar to find species that have become rare in the wild. Although the total area of the Democratic Republic of the Congo's hunting domains is not precisely known, they number about 30 and are scattered throughout the country. However, these areas, which should contribute to the protection of biodiversity, suffer from enormous issues that make them ineffective. The challenges they face represent a microcosm of the Democratic Republic of the Congo, including intensive poaching by local populations, logging (for charcoal, etc.), and encroachment for agriculture, gold mining and exploitation of other minerals. In particular, artisanal mining in hunting domains poses a dilemma, i.e. how to formalize an activity that is clearly proscribed by the Forest Code or how to prohibit an activity that is strongly supported by several civil society organizations, focusing on development and the basic needs of the local or even provincial economy, without providing alternative livelihoods? As such, the hunting domains do not enable biodiversity conservation, because the hunting domains seem to exist in name only.

Forests protected for water regulation

Although the Democratic Republic of the Congo includes the forested watersheds of major rivers that support important inland fisheries, as well as significant agricultural, industrial and domestic water use for the nation, freshwater "is just left to itself". On a scientific level, very few researchers have been interested in the issues of aquatic diversity and waterways. Those who are interested in this topic essentially either work in PAs or focus their studies on the taxonomic classification of fish, rather than on the challenges of freshwater ecosystem management. On the legislative level, only the Water Code (2015)[11] applies to all watercourses, wherever their situation in the national territory, and this does not have any specific provisions for the management of biodiversity.

1.6. CONCLUSIONS AND LESSONS LEARNED

In the Democratic Republic of the Congo, biodiversity conservation in forests outside PAs does not seem to be sufficiently integrated. As a result, biodiversity

[11] http://leganet.cd/Legislation/JO/2016/JOS.13.01.2016.pdf

conservation focuses almost exclusively on PAs. Laws, policies, regulations and even research seem to focus only on plant and animal biodiversity, at the species level, while leaving other types (e.g. soil, freshwater) and scales (e.g. genetic, landscape) of biodiversity on the sidelines. For example, microbial biodiversity and aquatic biodiversity seem to be of interest only to researchers and not to policymakers. This is partly due to the lack of appropriate technology to study them and the lack of interest in them by the current biodiversity management framework.

The rights of IPLCs who live mainly from the forests that they have always managed are not sufficiently respected. However, several initiatives, especially related to community forestry, are trying to rebalance this situation and some progress has been made. These efforts are justified by the proven link between recognition of IPLC rights and better biodiversity management. Nonetheless, the area covered and number of people involved remain paltry for a country the size of the Democratic Republic of the Congo.

The legal and institutional framework of the Democratic Republic of the Congo related to biodiversity allows for the management of plant and animal resources, but should be better harmonized to avoid inter and intra-institutional conflicts, in order to achieve a better integration of the issue of biodiversity management in all areas that may have an impact on it, and for a better consideration of the rights of IPLCs.

Finally, it should be noted that there is still a long way to go with regard to the management of forests or elements of high conservation value because they are barely listed in the Democratic Republic of the Congo and are therefore not fully protected.

The key lessons learned includes the following:

1. Leaving the conservation of biodiversity to the State has revealed limitations. Private initiatives are sometimes more effective. The involvement of the private sector through the establishment of a legal and regulatory framework might be an option. Such an initiative could be modelled after community forestry for the establishment of private biodiversity conservation concessions.
2. The concentration of conservation efforts in PAs does not allow for good biodiversity conservation in the Democratic Republic of the Congo. In addition to the fact that the PAs cover less than 17 percent of the national territory, they remain subject to severe pressure while the capacity of the State to respond is limited, thus reducing the effectiveness of their protection. In this context, the consideration of other types of biodiversity management is essential. The implementation of community conservation areas would allow participatory conservation, hence reconciling the needs of communities and biodiversity.
3. A significant obstacle to the conservation of certain types of biodiversity (e.g. aquatic, microbial, etc.) relates to the lack of sufficient knowledge about them for developing adequate conservation policies. Thus, the appropriate biodiversity research should be supported and prioritized.
4. The legal and regulatory framework of the Democratic Republic of the Congo relating to biodiversity management has some shortcomings that should be corrected. Some of the laws are out of date and unsuitable (e.g. the law on

fishing), others are not in harmony (e.g. the Forest Code, the mining code[12], etc.), while others, although commendable, are not well applied due to a lack of provisions for implementation. Harmonization of the legal and regulatory framework for biodiversity management would make the administration more effective.

5. Biodiversity management is a cross-cutting issue. This should be taken into account by setting up an inter-ministerial consultation framework in order to resolve jurisdictional conflicts and for proposing appropriate harmonization or policies.
6. PES initiatives allow for community involvement and an improvement in their living conditions, if they are well designed. These mechanisms can be promoted as an alternative to communities living in hunting grounds or other PAs.
7. FSC certification is an approach that supports sustainable forest management, including biodiversity concerns, and benefits the nation, local communities and Indigenous Peoples. It should therefore be the subject of an incentive policy (reduction of certain taxes for concessionaires engaged in the certification process, among others).

[12] www.cordaid.org/en/news/evaluation-of-revised-mining-code-and-sustainable-development-in-dr-congo

2. Ethiopia

Fabio Pedercini[1,2], Lars Graudal[1,2], Søren Moestrup[1,2], Wubalem Tadesse[3] and Ian K. Dawson[1,4]

1. CIFOR-ICRAF, World Agroforestry, United Nations Avenue, Gigiri, PO Box 30677, Nairobi, Kenya
2. Forest & Landscape Denmark, Department of Geosciences and Natural Resource Management, University of Copenhagen, Rolighedsvej 23, 1958 Frederiksberg C, Denmark
3. Ethiopian Environment and Forest Research Institute (EEFRI), Addis Ababa, Ethiopia
4. Scotland's Rural College (SRUC), Kings Buildings, West Mains Road, Edinburgh EH9 3JG, United Kingdom

2.1. CONTEXT

Anthropic pressures are threatening the conservation of biodiversity globally, particularly in tropical forests (Olson and Dinerstein, 1998; Miles *et al*., 2006; Dinerstein *et al*., 2017). At least two-thirds of terrestrial biodiversity thrive in these ecosystems (Gardner *et al*., 2009), of which more than 90 percent are currently found in human-modified landscapes (Chazdon *et al*., 2009). In Ethiopia, geomorphological variation and distinct terrains generate tremendous ecosystem diversity. Massive mountains and plateaus are separated by lowlands and the Great Rift Valley, which divide African biotic realms. Climatic conditions are also highly variable, in accordance with the topography. As such, these rich biophysical environments support a great diversity of life forms, with high endemism and genetic diversity, as exemplified by a range of studies on forest trees and other flora and fauna (e.g. FDRE, 2016a; Friis, Demissew and Breugel, 2010; Husen *et al*., 2012).

According to the latest national report to FAO's Global Forest Resource Assessment, over the last three decades forest cover in Ethiopia has decreased on average at a rate of 73 000 ha/year (FAO, 2020a). In fact, the annual loss of natural forests was estimated to be 100 000 ha, but this is partially compensated (in area) by an annual increase in commercial plantations of 23 000 ha. However, it is estimated that more than 70 percent of these plantations are planted with introduced timber species, such as *Eucalyptus globulus* and *Cupressus lusitanica*, representing much lower quality tree cover in terms of biodiversity. Ethiopia's annual rate of forest loss is among the highest in East Africa. By comparison, Uganda and Kenya are losing 41 000 ha/year and 8 000 ha/year, respectively, although Tanzania is losing significantly more at 388 000 ha/year (FAO, 2020b).

Ethiopia's forest sector is important to the rural and wider national economy. A diversity of forest resources is utilized to provide timber and non-timber forest products (NTFPs), and the country uses large quantities of wood for household energy. In 2013, the annual national consumption of fuelwood was estimated to be

124 million m^3, and is expected to be 158 million m^3 by 2033 (FDRE, 2017a). A study by Narita *et al*. (2018) estimated the economic benefits derived from Ethiopian forest products to be roughly USD 2.4 billion/year (2013 figures), of which fuelwood, timber and NTFPs were estimated to account for 14 percent, 46 percent and 37 percent, respectively. In comparison, the value of ecosystem services (e.g. climate regulation, carbon credits, biodiversity conservation and watershed protection) provided by Ethiopia's forest resources was estimated at USD 6 billion/year (2017 figures) in the latest Forest Sector Review (FDRE, 2017a).

A growing population, unsustainable exploitation of natural resources, high dependence on fuelwood as an energy source, land degradation, invasive alien species, and a changing climate, are some of the principal threats to Ethiopian forest biodiversity (FDRE, 2016a; Husen *et al*., 2012). Hence, human activities are causing major changes in vegetation cover (FDRE, 2016a). For example, the Eastern Afromontane biodiversity hotspot has been reduced to 10 percent of its original area (Burgess *et al*., 2005) and includes 677 threatened species (CEPF, 2011). About 75 percent of the vascular plants found in this biome are considered endemic to East Africa and 40 percent to Ethiopia (BirdLife International, 2012).

Although now over two decades old, the comprehensive overview of the Ethiopian policy-making process for the agriculture and natural resource management sectors published by Keeley and Scoones (2000) remains of interest. Following the election of the Ethiopian Peoples' Revolutionary Democratic Front in 1991, arguments in favour of modernizing the agricultural sector were prominent. In 1995, the government adopted the Sasakawa-Global 2000 programme[13], which expanded at a remarkable speed with 2.5 million farmers enlisted by 1998. However, with accelerating biodiversity loss and soil fertility decline negatively impacting crop yields, the policy debate expanded with the aim of halting environmental degradation. According to Keeley and Scoones (2000), two research projects were of considerable importance in nurturing this debate. The first was the Soil Conservation Research Project (SCRP), a national framework to collect soil erosion data that was established by Hans Hurni in 1981 (Hurni, 1988), and the second was the Ethiopian Highland Reclamation Study, which was published in several volumes by FAO (FAO, 1986). These national research initiatives, in parallel with the debate surrounding the development and implementation of the CBD and the United Nations Convention to Combat Desertification (UNCCD) in 1992 and onward, helped to shift political attention in Ethiopia towards natural resource management.

The first cross-sectoral environmental policy published by the Ethiopian Government, after the country had ratified its participation in the CBD in 1994, was the Environmental Policy of Ethiopia (1997) (FDRE, 1997). As a signatory to the CBD, Ethiopia had to comply with the treaty's target to substantially reduce biodiversity loss by 2010. During the last three decades, Ethiopian governmental institutions have increasingly recognized the need for regulating the utilization of natural resources to improve the conservation of natural ecosystems and support their contributions to livelihoods. To this end, Ethiopia has issued various proclamations,

[13] www.saa-safe.org/www/ethiopia.html

strategies and policies affecting the conservation and sustainable use of forests and biodiversity. Alongside and in theory guided by these, extensive restoration activities are being implemented. Ethiopia has set a national target of restoring 7 million ha of forest in its Climate-Resilient Green Economy strategy (FDRE, 2011) and has pledged to restore 15 million ha of degraded landscapes as part of the AFR100[14] (IUCN, 2021). Nevertheless, there is a major challenge in implementing the existing policy framework to support these targets.

2.2. BIODIVERSITY AND FOREST POLICY FRAMEWORK

Policy documents relating to biodiversity management in forests

Initial systematic scoping work for Ethiopia based on key word searches of document contents in a literature review identified four national policy-related pieces of particular relevance for forest biodiversity mainstreaming: the Growth and Transformation Plan, version 2 (GTP-II) (FDRE, 2016b); the National Biodiversity and Strategy and Action Plan (NBSAP) (FDRE, 2016a); the Forest Development, Conservation and Utilisation proclamation, version 2 (FDCU II) (FDRE, 2018); and the Climate-Resilient Green Economy (CRGE) strategy (FDRE, 2011). These documents therefore provide the foundation of the observations presented in this section.

Forest biodiversity depends fundamentally on forest plant, animal and microbial genetic resource conservation. In this regard, GTP-II (FDRE, 2016b) mandates upscaling of *ex situ* conservation practices for 2 000 plant species, more than 1 000 microbial species and eight animal species. Moreover, it mandates that *in situ* conservation be strengthened to ensure access to an increased number of plants, animals and microbes for sustainable use. The value of genetic resources is also discussed by Ethiopia's NBSAP (FDRE, 2016a). In addition to having targets for the increased application of *ex situ* and *in situ* conservation practices, GTP-II had aimed by 2020 (FDRE, 2016b) to expand the area of effectively managed protected areas (PAs) from 14 percent to 20 percent, and to reduce by 75 percent the areas colonized by invasive species (the authors of this case study have not been able to locate documentation indicating if these targets had been met by the 2020 milestone). Eradication measures have been prioritized for the alien species with the greatest impacts on biodiversity, while a framework is provided to monitor the distribution and spread of invasive species. In Ethiopia's FDCU-II proclamation, endangered economically important forest species are given priority for conservation planning (FDRE, 2018). The need for establishing a system for the management of indigenous and exotic tree species, with seed inputs adapted to different agro-ecologies, is also highlighted.

Access, utilization and benefit-sharing mechanisms of genetic resources are regulated by Ethiopia's Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation No. 482/2006 passed in 2006, where ownership is vested in the state and people (FDRE, 2006). The right of access is given to local

[14] www.wri.org/initiatives/african-forest-landscape-restoration-initiative-afr100

communities and governmental institutions, while any third party to be granted access must apply for a permit (to the Ethiopian Biodiversity Institute,[15] formerly the Institute of Biodiversity Conservation). Access can be denied when it is considered that it would negatively affect endangered species, the health or cultural values of local communities, or if the intended use is contrary to national laws or multilateral treaties. However, a list of protected tree species, although referred to as existing, is not reported in any document that was consulted by the case study authors (FDRE, 2017a, p. 71). A short sub-list of protected tree species was reported in an earlier repealed version of the FDCU (Proclamation No. 94/1994), which indicates that the utilization or harvest of *Cordia africana, Hagenia abyssinica, Juniperus procera* and *Podocarpus gracilior* are prohibited (FDRE, 1994). These four species are native to Ethiopia, though they also occur more widely in the East Africa region (G. Tadesse, personal communication, 2021).

Promoting the enforcement of existing policies is a key process for ensuring that forests are utilized without compromising their effective conservation. On this subject, GTP-II mentions that "systems and measures will be undertaken for [the] proper implementation of environmental laws" (FDRE, 2016b). The NBSAP, furthermore, specifies the need to address the underlying causes of biodiversity loss by "mainstreaming biodiversity across government and society" (FDRE, 2016a). FDCU-II specifies that no person within a state forest should cut trees, settle temporarily or permanently, graze domestic animals, undertake hunting or carry saws or any other tree cutting tool (FDRE, 2018). As such, trivial infringements are punishable with fines ranging from ETB[16] 1 000 (around USD 24, at 2021 exchange rate) to ETB 40 000. Serious violations carry penalties of imprisonment, varying from a minimum of 6 months (e.g. for illegally transporting forest products) to 15 years (e.g. for intentionally causing damage to a forest). Forest guards have the right to inspect, seize and report any person considered responsible for violations.

Ethiopia's CRGE strategy (FDRE, 2011) recognizes a wide range of forest ecosystem services, including biodiversity conservation, which is considered paramount for developing timber and NTFP utilization to reach GTP-II and CRGE green growth targets. The global value of Ethiopian forests' wild coffee genetic resources (the primary *centre* of origin and genetic *diversity* for *Coffea arabica* L., i.e. Arabica coffee) has been estimated to be as much as USD 1.5 billion in terms of their potential to support future breeding (Hein and Gatzweiler, 2006). To safeguard socioecological co-benefits, FDCU-II encourages that all of Ethiopia's natural forests be demarcated as productive, preserved or protected, and managed accordingly (FDRE, 2018). All of these forest categories, under all forms of tenure (e.g. private, participatory and state), are to be protected from invasive species, pests and diseases, and should apply curative measures when they occur. Private forest owners failing to inform the relevant body about the spread of forest vermin, weeds and diseases can incur penalties. In addition, forest conversion to promote farming or any other activity is punishable with imprisonment not less than two years.

[15] https://ebi.gov.et/
[16] ETB = Ethiopian Birr

Sustainable practices are promoted by most of the documents that were consulted. The CRGE strategy suggests that the sustainable management of forests and woodlots will lead to increased carbon sequestration, with an abatement potential of nearly 10 million tonnes CO2 equivalent (Mt CO2e) by 2030 (FDRE, 2011). Likewise, GTP-II indicates several activities to support the scaling up of best practices in forest management (FDRE, 2016b). These include establishing research facilities, distributing forestry development packages and training. GTP-II also seeks to identify and protect tree seed sources, and devise maps to guide purposeful tree planting, such as the National Potential and Priority Maps for Tree-Based Landscape Restoration in Ethiopia (MEFCC, 2018).

The documents consulted state that best practices must be implemented where forests are utilized for NTFPs. FDCU-II indicates that forests categorized as productive need to be administered according to a management plan developed by the responsible body once an inventory has been conducted (FDRE, 2018). The Forest Sector Review (FDRE, 2017a) indicates that investments in sustainably managed plantations are critical to ensure that Ethiopia closes its supply–demand gap in domestic wood production and suggests that establishing 310 000 ha of managed plantations would close the gap in future industrial roundwood[17] demand. Reichhuber and Requate (2007) estimated that the sustainable use of the remaining montane rainforest in southwest Ethiopia for semi-forest coffee production would produce the highest benefits to local and global communities, compared to other land use options. The NBSAP advises that the unsustainable utilization of biodiversity be reduced and that the loss of high-biodiversity habitats, including primary forests and wetlands, be prevented (FDRE, 2016a).

According to GTP-II, afforestation and reforestation programmes were expected to increase Ethiopian forest cover from 15.5 percent in 2014/2015 to 20 percent in 2019/2020 (FDRE, 2016b). However, a recent report indicated that total forest cover amounted to 15.2 percent of Ethiopia's total land area in 2020 (FAO, 2020a). The main benefits anticipated from the above programmes are related to livelihood provision and ecosystem services (Evans, 2018). The government applies a bottom-up approach to mobilize resources for tree planting, including increasing smallholders' awareness of the importance of sustainably managing land and other natural resources. Reforestation targets run alongside Ethiopia's nationally determined contributions (NDCs[18]), where increased forest cover is listed as a medium to long-term climate change adaptation strategy (FDRE, 2016c). However, Ethiopia's NDC strategy does not specify whether reforestation activities are to be carried out by the establishment of indigenous or exotic species, which implies that introduced, fast-growing tree species are more likely to be promoted.

CRGE identifies forestry as the sector with the largest GHG emission abatement potential, to be realized both by afforesting and reforesting degraded landscapes, and by reducing wood harvest for energy use through introducing fuelwood-efficient

[17] Timber which is left as small logs, not sawn into planks or chopped for fuel, typically taken from near the tops of trees and used for furniture manufacture.

[18] www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ethiopia%20First/Ethiopia%27s%20updated%20NDC%20JULY%202021%20Submission_.pdf

stoves. These interventions are expected to contribute 70 percent of the abatement potential of the sector (FDRE, 2011). Action programmes that contribute to increased forest cover are described in detail by the National Forest Sector Development Program[19] (FDRE, 2017b, 2018b, 2018c). The Land Degradation Neutrality technical report also indicates reforestation, using indigenous species, as a corrective measure where declines in productivity are evident (FDRE, 2016d).

Wildlife protection and utilization are regulated by the Development, Conservation and Utilization of Wildlife Proclamation No. 541/2007[20] (FDRE, 2007), which declares that no person may hunt game unless in possession of a permit. This restriction applies within and outside PAs. Wildlife conservation is also considered by FDCU-II, where it is indicated that no person is allowed to hunt within a state forest (FDRE, 2018). For private forests, the commercialization of wildlife must be accompanied by a permit issued by the Ministry of Agriculture and Rural Development (MOARD).

With further regard to the management of wildlife, GTP-II specifies that wildlife protection will be given high emphasis and that new wildlife zones will be demarcated and legalized (FDRE, 2016b). Biodiversity corridors to support wildlife and plant species migration are planned as an adaptation strategy in the NDC to combat the loss of biodiversity due to drought events (FDRE, 2016c). Additionally, one of the planned measures against land degradation is to establish green corridors on large-scale commercial farms that promote landscape connectivity favouring wild animal movement within fragmented landscapes. Establishing wildlife corridors is also mentioned in the NBSAP to improve the status of biodiversity (FDRE, 2016a).

Local community rights and forest biodiversity

The rights of local communities to use and benefit from forest resources is a key issue in biodiversity conservation in Ethiopia. GTP-II indicates plans to establish legal licensing systems for biodiversity, which are expected to improve the utilization of forest genetic resources (FDRE, 2016b). FDCU-II indicates that local forest-dependent communities may use forest resources in productive or protected state forests when in accordance with a management plan (FDRE, 2018). However, FDCU-II also indicates that when a local community's use of a state forest is in conflict with this plan, the community "shall evacuate the forest area and settle in other areas suitable for living". Nevertheless, the NBSAP states that local communities are granted access to genetic resources and to the fair and equitable sharing of benefits from their use (FDRE, 2016a). To improve the resilience of restored forest ecosystems and to prevent management conflicts, the Forest Sector Review (FDRE, 2017a) suggests that communities engage in forest management and claim land use rights.

Although of great relevance for biodiversity mainstreaming in forest management, local community knowledge was overall poorly covered. However, according to the

[19] www.et.undp.org/content/ethiopia/en/home/library/ten-year-national-forest-sector-development-programme.html

[20] https://leap.unep.org/countries/et/national-legislation/development-conservation-and-utilization-wildlife-proclamation-no

Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation (No. 482/2006[21]), local communities have the right to control access to their community knowledge on genetic resources (FDRE, 2006). Where benefits arise to other parties from granting access to this knowledge, these are to be shared appropriately. FDCU-II furthermore indicates that private forest owners should respect local culture and knowledge (FDRE, 2018). The Environment, Forest and Climate Change Commission (EFCCC[22]) plans to establish training centres to enhance indigenous knowledge in order to promote forest development. The central role of local community knowledge in the sustainable use of forest biodiversity is also recognized by the NBSAP, which indicates that this knowledge and associated practices should be documented and integrated into development strategies, with local community engagement (FDRE, 2016a).

Participatory forest management (PFM) was introduced to Ethiopia during the early 1990s and was shown to positively impact both forest conditions and the livelihoods of households participating in the southwestern part of the country (Gobeze *et al*., 2009). However, weak governmental support is a major challenge to effective PFM and it is far from being mainstreamed nationally. From 2018, FDCU-II introduced PFM into the legal framework for the management of state, association and community forests (FDRE, 2018). In addition, tax exemption schemes were introduced to promote the development of local ownership of association and community forests. Furthermore, FDCU-II indicates that the demarcation of forest land as productive, protected or preserved forest must be conducted through engagement with the local community (FDRE, 2018). Participatory and community-based approaches to natural resource conservation are considered effective and are also promoted by GTP-II (FDRE, 2016b).

Strengths and weaknesses of the current policy framework

To ensure the successful conservation of protected forests, FDCU-II suggests the establishment of plantations of fast-growing trees along the peripheries, for purposes of demarcation and for use by local communities for fuelwood and construction wood (FDRE, 2018). The proposal as it stands is, however, problematic. First, local community participation in this establishment activity is not specified, even though their involvement in species selection and planting would be paramount to ensuring success. Second, it is debatable whether such restrictions and demarcation will be effective and whether it would not be better instead to provide the local community with broader alternative sources of forest products. Third, the FDCU-II reference to fast-growing species probably means the use of exotic trees, such as *Eucalyptus globulus*, that are popularly planted across the Ethiopian Highlands. That being the case, it would go against what the FDCU-II includes in its listed strategies for the expansion of forest development technologies, where it states that priority should be given to "indigenous varieties that have high economic value and are under the threat of extinction" (FDRE, 2018).

[21] https://wipolex.wipo.int/en/text/234308

[22] www.devex.com/organizations/environment-forest-and-climate-change-commission-efccc-152182

The protection of endangered native species is understood to be a key issue for the preservation of forest biodiversity. In the case of Ethiopia, the NBSAP emphasizes the importance of protecting endemic, endangered and economically important species with improved *ex situ* conservation standards (FDRE, 2016a). Furthermore, FDCU-II states that no person has the right to harvest endangered indigenous trees growing in state or community forests (FDRE, 2018). Access to genetic resources may also be denied when it involves an endangered species. Despite these positive features, neither of the above documents included a list of the species that are considered endangered. FDCU-II specifies that the list "shall be determined by directives issued by the Ministry" (FDRE, 2018). A table of red-listed species is included in a country report for Ethiopian forest genetic resources submitted to FAO in 2012 (IBC, 2012), where more than 100 woody species were considered endangered. However, there is no indication whether and to what extent these species are protected. The current list of protected tree species was published in a repealed version of the FDCU from 1994 (FDRE, 1994) and it is in any case composed of only four species, so it does not adequately capture conservation needs.

The protection of genetic resources by promoting *in situ* conservation systems is stated in several reviewed documents. Promoting landscape structural and functional connectivity is known to be important (Klinga *et al*., 2019) and to have positive spill-over effects beyond directly targeted areas (Brudvig *et al*., 2009). Despite this, specific plans for promoting landscape connectivity as a means to conserve threatened indigenous species are mostly absent from the four critical documents identified in the literature review (FDRE, 2011, 2016a, 2016b, 2018), although the NBSAP proposes the establishment of wildlife corridors as a corrective measure to improve biodiversity (FDRE, 2016a). The Nationally Determined Contribution (NDC) supports the establishment of biodiversity movement corridors between forest patches along altitudinal gradients, as an adaptation measure to climate change (FDRE, 2016c). Meanwhile, the Land Degradation Neutrality plan promotes the creation of biodiversity grids within large agricultural estates (FDRE, 2016d). Overall, the attention given by Ethiopian policy to landscape connectivity appears to be too little for a country with such high potential for re-connecting natural forest patches by ongoing large-scale tree-based restoration initiatives, and where climate change is likely to have large impacts that may be countered by encouraging such connectivity, especially along altitudinal gradients.

Another key feature of any policy or proclamation is that it should clearly define roles and responsibilities to ensure effective implementation. Across the entire body of documents reviewed for this case study, however, the definition of institutional roles was found to be limited. Within the FDCU-II proclamation, the separation of regional and federal institutional roles with regards to the management of forest resources is complicated (FDRE, 2018). On the one hand, ownership of state forest resources is assigned to regional authorities, who are responsible for providing institutional arrangements for management and allocating budgets and manpower for implementation. On the other hand, the EFCCC is responsible for coordinating the efforts of responsible regional actors and may take over the administration of

a forest if it is not properly developed by the regional authority or if it becomes necessary for the federal government to administer it, because of its national or international significance. The proposed institutional roles require effective and frequent communication between regional and federal bodies, as well as monitoring to address potential mismanagement. The Forest Sector Review stresses the importance of strengthening the Commission's structure at the regional and district level "to support the implementation of forest laws" (FDRE, 2017a).

Overall, the discourse around environmental policies in Ethiopia appears to indicate a positive direction, especially in relation to local community participation in natural resource management, but the situation is more negative in relation to forest biodiversity (Table 1).

TABLE 1.
Policy trends identified from a review of consulted documents with regard to key biodiversity- and forest-related topics.

Topic	General trend	Highlights from reviewed policies
Forest biodiversity	Negative	Lack of planning for landscape connectivity
		Proclamation on wildlife outdated and inadequate
		Poor demarcation of forest borders and forest types
		Lack of extensive biodiversity data for planning and monitoring
		Outdated/inadequate endangered species list
Forest management	Positive	Introduction of management plans as a regulatory tool over all forest tenures to ensure sustainability
		Positive implementation of restoration, reforestation and afforestation activities
		Sustainable forest management included in strategies as a priority mitigation action
Local community	Positive	Recognition of community's ownership over utilized genetic resources and their traditional knowledge
		Participatory schemes promoted in practice and regulated by law
		Communities to be involved in the process of defining a forest as productive, protected, or preserved

Source: FDRE. 2011. Ethiopia's Climate-Resilient Green Economy: Green economy strategy. Federal Democratic Republic of Ethiopia (FDRE). www.undp.org/content/dam/ethiopia/docs/Ethiopia%20CRGE.pdf; FDRE. 2016a. Ethiopia's National Biodiversity Strategy and Action Plan 2015–2020. Federal Democratic Republic of Ethiopia (FDRE). www.cbd.int/doc/world/et/et-nbsap-oth-en.pdf; FDRE. 2016b. Growth and Transformation Plan II (GTP II) (2015/16–2019/20). Federal Democratic Republic of Ethiopia (FDRE). https://ethiopia.un.org/en/download/2447/15231; FDRE. 2018. Forest Development, Conservation and Utilization Proclamation. Proclamation No. 1065/2018: pp. 10068–10090. Federal Democratic Republic of Ethiopia (FDRE). http://extwprlegs1.fao.org/docs/pdf/eth182203.pdf

2.3. BIODIVERSITY AND FOREST POLICY IN PRACTICE

In addition to the literature review, the results of which were described above, a cross-sectoral stakeholder consultation was conducted on forest biodiversity mainstreaming in Ethiopia. Relevant stakeholders in civil society (representing local communities), governmental and academic institutions, international organizations, and the private sector, were asked to complete a standardized questionnaire.

Overall, the 12 respondents to the survey questionnaire considered biodiversity conservation to be poorly mainstreamed in forest management in Ethiopia. Most indicated that biodiversity is not deliberately mainstreamed into any existing forest tenure type. Some respondents suggested that unclear institutional responsibilities, poor consideration of biodiversity conservation in relation to forestry policies, and weaknesses of forestry institutions at regional and local levels, were potential reasons for current gaps. Nevertheless, many respondents felt that biodiversity is adequately covered in forest management policies, but that it is poor implementation and lack of policy enforcement that are the major challenges. Respondents indicated that behind this may be: lack of government commitment; unclear directives for enforcing existing proclamations; frequent institutional rearrangements; conflicts between institutions over the administration of resources; differences in awareness among actors with regard to policy content and the functioning of biodiversity; poor monitoring and reporting of infractions; and lack of coherence between regional strategies and federal policies. Some of these issues are explained further below.

Survey respondents suggested that the protection of threatened species is especially poor. Some indicated limitations in policies regarding the categories of protection, the species to be protected under each category, and the prohibitions linked to a category. Additionally, the absence of a directive that determines which species are to be protected was noted. There was disagreement among some respondents on whether habitat protection is effectively incorporated into forest management policies and written strategies, with a number considering that it is (at least at this paper level) and others not. In any case, respondents felt that the translation of existing policies on habitat protection into actual practice is poor. Several respondents indicated that ecosystem services are poorly addressed by current policies. One respondent stressed the importance of undertaking estimates of the monetary value of forest ecosystem services to support their incorporation into forest policies and strategies.

Some of the major regulatory-related barriers to biodiversity conservation in forest management identified by respondents were: insufficient recognition by the government of forest landscapes as an important component of biodiversity; legal and institutional gaps; the absence of a national biodiversity database to strengthen monitoring; weak forestry institutions; and lack of awareness, as well as insufficient knowledge of the concept of biodiversity. They also pointed out several conflicts between existing regulations and policies. The agriculture and forestry sectors were described as having conflicting legal frameworks and interests. The example of investments allocated to the coffee industry was given, with policies for upscaling coffee production in southwestern Ethiopia posing a major threat to the conservation of the Afromontane Biodiversity Hotspot. Poor coordination between research and extension institutions was identified as another source of conflict.

Various changes to improve biodiversity management in forest landscapes were suggested by survey respondents. There is general agreement that institutional capacity needs to be strengthened. In addition, one respondent indicated that existing forest policies and regulations should be scrutinized and then harmonized, and a common definition of biodiversity be integrated. An update of the legal framework linked

to an up-to-date and open-access database on forest and biodiversity conservation areas was suggested as a key improvement. Other stakeholders pointed out that more emphasis should be given to subsidy schemes and benefit sharing mechanisms. Respondents also stressed: the importance of defining who is responsible for wild animal management outside Protected Areas and National Forest Priority Areas; the need to establish protocols which clearly state the frequency of monitoring forest law enforcement; the requirement of improving coordination between institutions; the need to promote proven interventions on the basis of lessons from ongoing tree planting; and the importance of promoting indigenous species in regulations for tree-based restoration.

Local community rights and forest biodiversity

Survey respondents had different views on whether cultural values are effectively incorporated into forest management policies and strategies. Most indicated that cultural values are not included or only to a minimal extent. Although PFM schemes are widely promoted for the protection of forest and tree species, a view was that cultural values are not given sufficient emphasis within the PFM framework. However, as pointed out by one respondent, FDCU-II includes new forest tenure types that have the clear objective of recognizing the rights of forest communities, while participatory approaches to forest management, forest land demarcation, and forest resource utilization, are all covered by the proclamation (FDRE, 2018). This respondent also observed however that "participation requirements are not sufficiently strong to ensure that community feedback is reflected in management decisions from the early stages of planning".

Responses varied in their position on whether resolution mechanisms for disputes among local communities and other stakeholders exist. Most respondents indicated that such mechanisms are not in place or are only incorporated into existing processes to a limited extent. A few respondents pointed out, however, that although conflict management frameworks are not directly provided for within policies and strategies, community bylaws and customary mechanisms are commonly in place to deal with disputes among PFM community members.

Strengths and weaknesses of the current policy framework

Consulted stakeholders consider that the existing regulatory framework around the forest sector is generally reasonably strong, with some advances made in more recent policies. For example, in comparing the new forest proclamation (FDCU-II) to its predecessor, advances are recognizable in the promotion of public participation, forest tenure and the sustainable utilization of forest resources. As already noted, however, stakeholders are concerned with the weak implementation of policies and strategies, and they consider this represents a major challenge to mainstreaming biodiversity in forest management.

Respondents also indicated specific policy gaps. For example, the rights of local communities are not well incorporated within forest policy and regulations, with their observed participation during the first stages of planning and in designing

management plans considered low, despite the new forest law (FDRE, 2018) including articles safeguarding community rights to the access and use of forests. Few survey respondents touched on the issue of biodiversity management under community forest tenure, but it was noted that respondents' views were that community members are primarily concerned with managing forests based on their economic interests rather than the environment. Linking the private sector and government with forest users' associations to establish incentive payments to protect forest habitats was mentioned by one survey respondent as a possible way forward.

Other suggestions to improve the regulatory framework around biodiversity in forest management were made by surveyed stakeholders. Investing in the establishment of strong and effective forestry institutions at all levels would ameliorate current gaps. The role of institutions should be clarified in a way that avoids conflicts or overlaps, and coordination and synergy between governmental agencies should be strengthened. One survey respondent identified the lack of a clear directive identifying "which species are protected under each [forest] category" as an issue to be addressed.

2.4. INSTITUTIONAL ARRANGEMENTS AND FOREST BIODIVERSITY

Continual institutional restructuring is a feature of the forest sector in Ethiopia, as illustrated by the changes implemented over the last decade. In 2013, forestry management moved from the Natural Resource Directorate of the Ministry of Agriculture to the Ministry of Environment and Forest (Mekonnen and Bluffstone, 2014; Tadesse, Worku and Kang, 2020); positively, this represented the first time that the word "forest" appeared in the name of an Ethiopian government ministry). In 2015, the Ministry of Environment and Forest was however renamed and restructured to become the Ministry of Environment, Forest and Climate Change (MEFCC), and then in 2019 this was restructured again into the Environment, Forest and Climate Change Commission (EFCCC[23]) under the Prime Minister's Office. The Ethiopian Wildlife Development and Conservation Authority has also been being passed from one ministry to another over the years (Debella, 2019).

This frequent restructuring of institutions – based in part on a lack of activity-based organization, inadequate attention to the forestry sector compared to agriculture, and the absence of a systematic analysis of organizational structures – has been identified as a constraint on the effective utilization and conservation of forest resources (Berhanu, 2009; FDRE, 2017a; Tadesse, Worku and Kang, 2020). The quality of data collected by institutions, the implementation of plans, and financial efficiency, have all suffered as a result. The Forest Sector Review (FDRE, 2017a) further highlighted how high rates of staff turnover have contributed to the weakening of institutional memory.

In addition to the EFCCC and the Ethiopian Wildlife Development and Conservation Authority, other relevant federal agencies for forest biodiversity management are the Ethiopian Biodiversity Institute, which focuses on *in situ* and *ex situ* biodiversity conservation, and the Ethiopian Environment and Forest Research

[23] www.efccc.gov.et

Institute, which carries out forest research and realizes forest development plans. The Ministry of Agriculture is only marginally linked to forests and biodiversity, through programmes such as the Resilient Landscapes and Livelihoods Project, a 5-yr initiative approved by the Green Climate Fund (GCF) in 2020 with a total budget of nearly USD 300 million (GCF, 2021).

At regional and local levels, the EFCCC only has very limited capacity (FDRE, 2017a, p. 72). Regional governments have different organizations responsible for forest and biodiversity conservation, which contributes to fragmentation in management. Some regions have no regional forest enterprise bodies and the Bureau of Agriculture is responsible for their forestry management (FDRE, 2017a, p. 76), in collaboration with the EFCCC. Poor institutional arrangements at the regional level create conflicts of interest between business and conservation (Debella, 2019).

2.5. A PRACTICAL EXAMPLE OF FOREST BIODIVERSITY MANAGEMENT

In this section, the Ethiopian government's framework for conserving forest biodiversity is linked with practice through the specific example of the Provision of Adequate Tree Seed Portfolio in Ethiopia (PATSPO[24]) project, an initiative that supports national forest restoration through improved tree seed sourcing. The information provided here to support this example comes from PATSPO project documents, from a survey questionnaire directed specifically to PATSPO staff, and from the involvement of the current authors in this initiative (FP, LG, SM).

In a recently published comprehensive book of reforestation efforts in Ethiopia (Tadesse, Worku and Kang, 2020), the book's authors identified the lack of an efficient network of tree seed centres that supply suitable planting material as a major challenge to effective tree-based rehabilitation. Dedefo *et al*. (2017) also found the low quality of tree seedlings available to be an important barrier to planting in the Oromia region, while other authors have found the same constraint applies more broadly across the country (Derero, 2011, 2012; Sisay, Alemu and Mariam, 2020; Höhl *et al*., 2020). Tree improvement trials have been conducted for only nine tree species in Ethiopia, of which only four were native and only two had certified seed sources (IBC, 2012). The issue is significant because when tree-based restoration is carried out using genetically-poor planting material of only a few species, losses in terms of environmental service provision and livelihoods benefits are often enormous (Jalonen *et al*., 2018).

PATSPO's aim is to address this gap by providing high-quality tree germplasm matched to planting sites and planting purposes for a range of priority tree species, including indigenous trees that diversify treed landscapes (ICRAF, 2017). Four years into PATSPO's implementation, and in collaboration with two Ethiopian forestry state enterprises, the project has established 26 breeding seedling orchards that are seed sources of 13 different priority trees, and has established a registry of a large number (>100) of existing indigenous tree seed sources. Crucially, collaboration among stakeholders involved in the tree seed sector has been enhanced by establishing a national tree seed network, and PATSPO has carried out several education and

[24] www.worldagroforestry.org/project/provision-adequate-tree-seed-portfolio-ethiopia

capacity-building initiatives to train participants in tree seed procurement and tree improvement (ICRAF, 2021). A climate change atlas that guides planting of over 100 indigenous tree species, taking into account climate change, has also been developed (Kindt *et al*., 2021).

To support positive outcomes, the objectives of PATSO have been aligned closely with Ethiopian government policy to promote the tree seed sector to: (i) provide the country "with [a] sufficient amount of plant seed and seedlings of tree species that could have different economic benefits"; (ii) give "technical support to those engaged in raising and supplying tree seedlings to society"; and (iii) support "a system to supply seeds of indigenous or exotic tree species that are suitable to the different ecosystems" (FDRE 2007b). The Forest Sector Review (FDRE, 2017a) also pointed out how the provision of quality tree seedlings to improve the productivity of small-scale plantations was a prerequisite for establishing a successful public-private partnership between the Oromia Forest and Wildlife Enterprise, private investors and smallholder farmers.

PATSPO is also supporting the Ethiopian government with the first national tree seed proclamation and tree seed policy that are currently being taken through the legislative process. These aim to support the involvement of the private and informal sectors in tree seed supply, as well as to provide a legal foundation to enhance the procurement of high-quality tree germplasm.

2.6. CONCLUSIONS AND LESSONS LEARNED

Ethiopia harbours important forest biodiversity in a global context, but its forests continue to be lost, and plantations that replace natural forest are often of a few exotic species. At the same time, Ethiopia has massive pending forest restoration targets and the potential to improve current restoration practice is significant, both in terms of livelihoods and environmental impacts. The various proclamations, strategies and policies were reviewed that affect the conservation and sustainable utilization of forests and biodiversity in Ethiopia and key stakeholders were consulted from across the biodiversity and forestry sectors. Most of the policy framework for mainstreaming biodiversity in forest management in Ethiopia was found to be in place, and moreover this framework has moved in a positive direction in recent years in some respects. Nevertheless, further policy development is needed to harmonize issues such as: local community knowledge and participation; when and where to focus on indigenous tree species for planting compared to exotics; what are the priority species for conservation; and measures that promote landscape connectivity. Likewise, policy development action is needed in the further development of payments for ecosystem service opportunities and in fully describing national, regional and local institutional management responsibilities so as to avoid overlaps and conflicts of interest.

Of primary concern is not the policies themselves, but their poor implementation and enforcement. This is seen by consulted stakeholders to be the greatest barrier to mainstreaming biodiversity in forest management. The issue is exemplified by the Forest Sector Review which states that "building capacity to enforce laws should be

prioritized for good forest governance".

This study has identified the following priority actions to support biodiversity mainstreaming in forest management in Ethiopia. There is a need to:

- Establish a formal national list of tree species prioritized for protection. This will allow for better targeted *in situ* and *ex situ* conservation actions to be taken.
- Clarify the type of species that should be used in tree planting, and whether and when the focus should only be on indigenous species. So far, insufficient emphasis has been placed on the importance of carrying out reforestation by planting locally-adapted native tree species, with instead too much reliance on commercial exotic trees.
- Support tools to assist biodiversity and forest monitoring and intervention design, including a forest biodiversity database. This could be part of a national monitoring system for forests and biodiversity.
- Address institutional weaknesses, including the overlap and confusion in roles among institutes and different levels of government.

3. Finland

Matti Ylänne and Lauri Saaristo

Tapio Services Ltd[25], Maistraatinportti 4 A, 00240 Helsinki

3.1. CONTEXT

Finland is the most forested country in Europe

Finland is relatively speaking the most forest covered country in Europe. Seventy-six percent (23 million ha) of Finland's land area is forest land. In addition, a notable area of land (3 million ha) is treeless or almost treeless forest land, including open peatlands and rocky ground. Forest land also includes other land uses, such as forest roads. The share of forest land in the land area of Finland has not changed much in recent decades. Finland contributes about 11 percent of the total forest cover of Europe. In total, Europe has 215 million ha of forest which is about 35 percent of the land area. After Finland, the most forest covered European countries are Sweden (74 percent), Montenegro (70 percent) and Slovenia (63 percent) (Korhonen and Stahl, 2020).

In Finland, the share of protected forest is also the highest in Europe. The total area of strict protection is over 2 million ha, or 10 percent of the Finnish forest area. All forestry operations are forbidden in these areas. Moreover, in Finland the majority of protection is strict protection. However, the proportion of protected forest varies substantially between regions. Nearly 80 percent of the total protected area is in Lapland, whereas in southern Finland there is scope to increase protection (Ihalainen *et al*., 2019.)

Finland's forests belong almost entirely to the boreal coniferous forest belt, which is divided into the southern boreal, middle boreal and northern boreal sub-zones. Forest stands are classified mainly according to on-site fertility, where six forest site types can be distinguished throughout the country. About two-thirds of forest land occurs on mineral soil, while the remaining third is over peat. Finnish commercial forests are considered semi-natural ecosystems due to the use of native species and natural regeneration, which nowadays accounts for 20 percent of the area regenerated. Planted areas also get additional natural seeding from neighbouring forests (Ihalainen *et al*., 2019.)

The total growing stock[26] of Finnish forests on forest and low-productive land amounts to 2.5 billion m^3 and 90 percent of this growing stock is located on land

[25] https://tapio.fi/briefly-in-english/

[26] Volume of all living trees in a given area of forest or wooded land that have more than a certain diameter at breast height. It is usually measured in solid cubic metres (m^3).

available for wood production. The annual increment of the growing stock is 108 million m^3. During 2010–2019, the total annual drain of growing stock was about 81 million m^3, of which logging accounted for about 68 million m^3. Thus, Finnish forests are growing more than they are being cut down. The Natural Resources Institute[27] estimated that the maximum sustainable harvest rate of forests in the ten-year period 2016–2025 is 80.5 million m^3 of stem wood[28] per year. During 2019–2020, logging was approximately 90 percent of that level. Taking a longer perspective, Finland's total wood resources were about 1.5 billion m^3 in 1970. Fifty years later, in 2020, they amounted to approximately 2.5 billion m^3. Over the same 50-year period when total wood resources increased by 1 billion m^3, a total of 2.5 billion m^3 were harvested mainly for the use of the forest industry (Ihalainen *et al*., 2019.)

A close view of Finnish forests

The livelihoods and cultural development of Finnish people have long been tied to forests and their natural resources. Forest management in Finland is based on the use of native tree species, even though the number of tree species is small. There are only four coniferous species native to Finland, and fewer than 30 deciduous trees and arborescent shrubs. The majority of forests in Finland are predominantly coniferous, with broad-leaved tree species growing in mixed stands. By volume of Finnish forest, 50 percent is Scots pine (*Pinus sylvestris*), 30 percent Norway spruce (*Picea abies*) and 17 percent birch (*Betula pubescens* and *B. pendula*), with the remaining 3 percent being other broadleaved trees.

Forests are generally managed quite intensively with practices based on silviculture, regular thinnings and clear-felling. As part of forest management, 47 percent of Finland's mires have been drained. The remaining undrained peatlands are mostly among the least fertile sites, with the share of undrained peatland considerably higher in northern Finland. The proportion of growing wood stock on mires is 23 percent and its importance is increasing (Ihalainen *et al*., 2019.)

Family forests predominate

Finnish forests, like in other Western European countries, are largely owned by private individuals and families and the holdings are quite small. The number of forest holdings with more than two hectares of forest is 347 000 and the average size of these holdings is 28 ha. Moreover, the number of forest owners is greater than the number of holdings since often couples own the property together. As such, the number of people owning forest is estimated to be about 685 000 or 12 percent of the Finnish population (Vaahtera, 2021).

In Finland, 61 percent of the productive forest land is in private ownership, 25 percent is state-owned and 8 percent is owned by forestry companies. The remaining 6 percent is held by municipalities, parishes, in joint ownership or in the ownership of other small organizations (Vaahtera, 2021).

Private forest owners have 64 percent of the total growing stock and 70 percent of

[27] www.luke.fi/en/

[28] Stem wood means the trunk of the tree, excluding the roots, branches and needles.

the growing stock in forests available for wood supply. Due to the small size of the majority of forest holdings, many private forest owners conduct forestry operations only very seldomly. Due to these circumstances, the role of forest manager, such as the forest management association, forestry company, or an independent service provider, who provide services to the forest owners, is critical in supplying forest management expertise.

State forest

State-owned forests are mainly situated in northern Finland, and the State also owns most of the nature conservation and wilderness areas. State-owned forestry land is managed by Metsähallitus (the state forest authority)[29]. About 38 percent of state-owned forest land is in commercial use, whereas 39 percent are statutory protected areas (PAs). The remaining 23 percent are non-productive or other special areas where the impact of forestry is low.

The Parks and Wildlife unit of Metsähallitus manages PAs, recreation areas and cultural heritage sites owned by the state. Metsähallitus Forestry Ltd manages state-owned production forestry land, with forestry operations based on the principle of multiple use of forests. As such, landscape-based participatory planning concepts are applied during the natural resource management planning process and are continued over into the forest operations phase.

Multiple use of forests and everyman's rights

In Finnish forests, anyone can visit and pick berries and mushrooms freely. These activities do not need a permit, not even on private land. Recreational use is based on statutory and traditional everyman's rights[30]. Nevertheless, the precondition is that the exercise of everyman's rights does not cause harm or damage to land use, nature or other users of everyman's rights. However, hunting, collecting fuelwood, making a fire and driving a motor vehicle always require the permission of the landowner. As Finnish forests are characterized by their multiple uses, in the same forest you can pick berries, hunt, hike, grow industrial wood and support biodiversity. Likewise, although forest roads are built mainly for the needs of forestry, while much of the recreational use of forests in Finland takes place in commercial forests, they also serve the population by giving access to forest areas for multiple uses. The growing popularity of forest-based nature tourism and recreational use will increase the need for coordination between different objectives, inclusive decision-making and cooperation between stakeholders (Ministry of the Environment, 2021a).

Forest inventory, monitoring and evaluation

The Finnish Natural Resources Institute conducts a national inventory of the nation's forests every 10 years which has been conducted since the 1920s. Measurable structural features affecting biodiversity have been included in recent inventories. In addition, the Natural Resources Institute provides centralized statistics on

[29] www.metsa.fi/en/

[30] https://new.visitfinland.com/en/articles/finnish-everyman-rights-the-right-to-roam/

commercial logging and forest management operations (Vaahtera, 2021).

The Finnish Forest Centre surveys the environmental quality of managed private forests through a small sample of forest stands and the results are available in public reports. Factors assessed include the number and volume of living retention trees and decaying trees, buffer zones for water bodies, the protection of valuable habitats and possible damage to remaining trees and soil. The regional Centres for Economic Development, Transport and the Environment[31] and Metsähallitus' Parks and Wildlife Finland[32] monitor the implementation of forest protection at the regional level. The Natural Resources Institute of Finland and the Finnish Environment Institute are responsible for monitoring forest protection at the national level. Meanwhile, forestry companies and Metsähallitus internally monitor and evaluate the quality of forest management and other forestry activities in their respective areas. As such, inventory and monitoring information is continuously used to update forest information systems and develop forestry plans (Siitonen *et al*., 2020).

Forest and environmental organizations

The highest forest authority in Finland is the Ministry of Agriculture and Forestry, whose mandate is to create conditions for the sustainable and diversified use of renewable natural resources and to secure the quality of the commodities obtained from them. The Department of Forestry within the Ministry is charged with directing and developing forest policy in Finland. The Ministry of the Environment is the highest authority in Finland concerned with climate, communities, built environment, housing, biodiversity, sustainable use of natural resources and environmental protection (Ministry of the Environment, 2021b).

Metsähallitus, the Nature Resources Institute and the Finnish Forest Centre are all under the performance guidance of the Ministry of Agriculture and Forestry. The Finnish Forest Centre is responsible for promoting sustainable forest management (SFM), protecting forest biodiversity and promoting other activities within the forest sector. Metsähallitus manages, uses and protects the natural resources and other assets on State lands under its administration. Forests and forestry are studied in Finnish universities and research institutions by about 650 researchers, with more than half of them working in the Natural Resources Institute. The function of the 59 forest management associations in Finland is to promote the profitability of forestry as practised by forest owners. The forest management associations[33] are members of the national interest group, the Central Union of Agricultural Producers and Forest Owners[34]. There are also organizations for forest and wood products industry employers, employees, contractors and other interest groups.

Many environmental and nature conservation non-governmental organizations (NGOs) promote the protection and more sustainable use of forests. Among their activities, they produce information on high conservation value forests

[31] www.ely-keskus.fi/web/ely-en
[32] www.metsa.fi/en/about-us/organization/business-units/parkswildlife-finland/
[33] www.mhy.fi/metsanhoitoyhdistykset
[34] www.mtk.fi/web/en

(HCVFs), prepare action proposals and recommendations, participate in political processes related to forest use, as well as organize different nature-related activities. Organizations working actively with forest biodiversity include BirdLife Finland[35], Greenpeace[36], the Finnish Nature League[37], the Finnish Society for Nature and Environment (Natur och Miljö)[38], The Finnish Association for Nature Conservation[39] and WWF Finland[40].

3.2. BIODIVERSITY POLICY, FOREST POLICY AND REGULATIONS

International agreements on biodiversity

Finland has ratified several international conventions whose signatories are committed to promoting the protection and sustainable management of biological diversity. These conventions include the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1979)[41], the CBD, the Pan-European Biological and Landscape Diversity Strategy of the cooperation process between European environmental ministries (PEBLDS, 1995), and the resolutions of the 1993–2011 Ministerial Conference on the Protection of Forests in Europe (FOREST EUROPE)[42] (Rasi, 2020).

Finland participates actively in international forest policy and cooperation and is committed to implementing its international obligations. These and EU objectives are incorporated nationally in various policy programmes and strategies. The National Forest Programme 2015[43], the National Strategy for Sustainable Development (Voluntary National Review, 2020), the Forest Biodiversity Programme for Southern Finland (METSO)[44], the National Climate and Energy Strategy[45], Finland's NBSAP 2012–2020 (Sarkki *et al*., 2016; Auvinen *et al*., 2020), as well as the Finnish development policy in forestry, are consistent and supportive of each other. As such, international agreements have been implemented in legislation and in other guidelines. Moreover, the forest legislation regulating the sustainable management and use of forests gives special attention to biodiversity protection. Economic policy instruments along with research and education also play an important role in achieving the international objectives.

---

35 www.birdlife.fi/in-english
36 www.greenpeace.org/eu-unit
37 www.luontoliitto.fi/en
38 www.naturochmiljo.fi/om-oss/vem/in-english
39 www.sll.fi/en
40 https://wwf.fi/en
41 www.coe.int/en/web/bern-convention
42 https://foresteurope.org
43 https://julkaisut.valtioneuvosto.fi/handle/10024/80524
44 www.metsonpolku.fi/en-US/METSO_Programme
45 https://valtioneuvosto.fi/en/-//1410877/climate-and-energy-strategy-comprehensively-to-outline-the-measures-required-by-the-2035-goal

National forest programmes, biodiversity programmes and other forest-related programmes

Forest programmes have played an important role in Finland, both as an instrument of forest policy and in the provision of funding for forestry. The latest National Forest Strategy 2025[46] describes the main strategic vision of the forest sector as "The sustainable use and management of forests is the source of increasing well-being". The strategy goals are:

1. Finland is a competitive operational environment for businesses based on forests.
2. The forest sector and its structures will be renewed and diversified.
3. Forests are in active, economically, ecologically and socially sustainable and diverse use.

The Forest Strategy 2025 aims to achieve the 2030 Agenda goals related to forests and now takes into account climate sustainability and the safeguarding of forest biodiversity more clearly than before.

In 2008, the Government also adopted the Forest Biodiversity Programme for Southern Finland 2008–2016 (METSO). The aim of this voluntary programme is to improve the maintenance of habitats and structural features of forests vital to the survival of threatened species, and this will continue until 2025. The Ministry of Environment also started a habitats programme[47] that runs from 2020 to 2030. The programme aims to enhance biodiversity by protecting and restoring mires, restoring aquatic bird habitats, wetlands and coastal areas, managing semi-natural grasslands, restoring forest habitats, such as herb-rich forests and sun-exposed esker forests[48], and managing and restoring coastal environments, such as sandy beaches. The programme will focus on PAs initially and later be extended to other areas on a voluntary basis, where forest owners shall be encouraged to protect habitats that fit under the programme.

Finland's National Strategy for Sustainable Development was adopted by the Government in 2006, and aimed at achieving ecological sustainability by creating the economic, social and cultural preconditions to meet this end. The latest revision was published in 2020 (Voluntary National Review, 2020). The aim of Finland's National action plan for the conservation and sustainable use of biodiversity (NBSAP) (2013–2020), titled *Saving Nature for People*, is to halt the decline of biodiversity in the country, and to establish a favourable development of biodiversity in the long term (Ministry of the Environment, 2013). An Impact Assessment of the Implementation of the NBSAP was published in August 2020 (Ahokumpu *et al*., 2020). The research group found that the mainstreaming of biodiversity has progressed well in different administrative branches and that the private and civil society sectors were able to support the policy. However, although a knowledge base and structural framework to safeguard biodiversity have been established, the action taken has not been effective enough to halt the loss of biodiversity. It is necessary to implement a socially and economically fair ecological transition throughout society in order to minimize

[46] https://julkaisut.valtioneuvosto.fi/handle/10024/161739
[47] https://ym.fi/en/helmi-habitats-programme
[48] www.metsa.fi/wp-content/uploads/2017/05/Lindberg_esker_forests-1.pdf

pressures on nature and reach a sustainable society that takes biodiversity into account in all its operations (i.e to mainstream biodiversity conservation across all sectors). The research group also presented some recommendations for the next Finnish biodiversity action plan (2021–2030)[49]. There were five measures related to forests, covering the METSO programme, National Forest Programme, regional cooperation and commercial forests, research forests and land for recreational use, all owned by the State and managed by Metsähallitus (Auvinen *et al*., 2020).

Legislation[50]

The first Forest Act was established in 1886 in Finland. It included an order that forest regeneration after logging is compulsory: destroying forests is illegal.

Practically all Finnish legislation on forest use and management and nature conservation was reformed in the mid-1990s.[51] The purpose of the Forest Act is to promote the economically, ecologically and socially sustainable management and use of forests. In the 1997 revision of the Forest Act, the requirement to maintain forest biodiversity emerged alongside wood production as an important aim of forest management. The Forest Act sets minimum requirements for the management and use of forests, based on which the forest owner makes detailed forest management decisions in accordance with his or her own objectives. These requirements concern, among other things, timber harvesting, forest regeneration and safeguarding forest biodiversity. The Forest Act contains definitions of habitats of special importance that must be protected whether or not the sites are known or mapped.

In addition to the Forest Act, the use of forests is also regulated by the Government Decree on the Sustainable Management and Use of Forests, as well as, for example, the laws on the prevention of forest damage and the financing of sustainable forestry. There is also legislation on, for example, trade in forest seeds and seedlings, timber measurement, joint forests and forestry organizations.

Forestry is also widely affected by environmental legislation, such as the Nature Conservation Act (1923, last revised 1996)[52], which regulates different types of nature reserves, species protection and protected habitats, landscape areas and nesting trees. The Nature Conservation Act lists nine protected habitat types, three of which are found in forests.

The aim of the Finnish Water Act[53] (1961, last revised 2011) and water decree is to safeguard the sustainable use of water resources, to prevent damage to water use and to improve the quality of water resources and water environment. The Water Act has a large influence in forest operations by requiring measures to minimize impacts on water, especially in peatland forest ditching, but also for logging and other operations.

The Land Use and Building Act[54] (1856, last revised 1999) provides for, among other things, zoning, which may have an impact on forest use. When preparing town

[49] www.cbd.int/doc/nr/Finland.pdf
[50] https://mmm.fi/en/forests/legislation
[51] https://blogs.loc.gov/law/2018/12/on-the-shelf-finnish-forest-and-forestry-laws
[52] https://ym.fi/en/reform-of-the-nature-conservation-act
[53] www.ecolex.org/details/legislation/water-act-no-587-of-2011-lex-faoc173197
[54] https://ym.fi/en/land-use-and-building-act

and general plans, the different forms of forest use are coordinated at the regional and municipal level. The legislation requires that landowners and other stakeholders are given the opportunity to be consulted and involved in the process of preparing the plans.

Voluntary guidelines and measures

Apart from legislation, the use of forests is also guided by various instructions and guides. Tapio's Best Practice Guidelines for Sustainable Forest Management[55] bring together tools and options for SFM. They were developed with input from more than 25 organizations, including industry and NGOs. They go beyond the law in ensuring economically, socially and environmentally SFM. Forest management recommendations are widely used by forest owners and professionals in the field (Äijälä *et al*., 2019). Other organizations have also published various guides on, for example, forestry, nature management, restoration and water protection. One example is the guide *White-backed woodpecker and commercial forestry*[56]. Forest management in state forests is conducted according to Metsähallitus' own environmental guidelines[57] (Kaukonen *et al*., 2022).

Forest biodiversity is also taken into consideration in large-scale commercial forests. In addition to legislation, the management of nature in commercial forests is based on forest certification, voluntary guidelines and recommendations. Besides habitats of special importance under the Forest Act and protected natural habitats under the Nature Conservation Act, other valuable natural sites are excluded voluntarily from forest management activities by forest owners and forest operators. Biological diversity is also taken into consideration during logging and other forest management activities, for example, by increasing the proportion of deciduous trees, decaying stems and large mother trees. Finland has many lakes, rivers and other small water bodies, and peatland in forests, making it important to pay particular attention to water protection during forestry operations, for example by leaving untouched buffer zones along waters (Finér *et al*., 2018). The greatest impacts on water are caused by peatland forest ditching, regeneration felling and related ground preparation and fertilization. To mitigate these types of impacts, for example, Monimetsä[58] (Finnish for *Multiforest*) – Nature management as a part of normal everyday forestry – is a name of a development project (2016–2022) for increasing the knowledge of forest owners and strengthening the know-how and skills of professionals in methods for nature and biodiversity management, funded by the Ministry of Agriculture and Forestry.

Forest certification

Forest certification is a mechanism for forest monitoring, tracing and labelling timber, wood and pulp products and non-timber forest products (NTFPs), where the quality of management from environmental, social and economic perspectives

[55] https://tapio.fi/wp-content/uploads/2021/05/One-pager-Best-Practice-Guidelines-for-Sustainable-Forest-Management-Finland.pdf
[56] www.ymparisto.fi/fi-FI/Luonto/Uhanalainen_valkoselkatikka_voi_menestya
[57] www.metsa.fi/en/nature-and-heritage/forest-environment/environmental-guidelines
[58] www.metsakeskus.fi/fi/hankkeet/monimetsa

is judged against a series of agreed standards. The key to forest certification is the development of a system that combines auditing forest practices with tracing forest products. In Finland, the first forest areas were certified by the Programme for the Endorsement of Forest Certification (PEFC) in 2000 and by the Forest Stewardship Council (FSC) in 2011. As of 2021, PEFC certification covers over 90 percent (18.5 million ha) and FSC certification 9 percent (2 million ha) of the total area of forest land in Finland. Nearly all FSC certified forest areas are also PEFC certified.

Protection of forests and biological diversity

Statutory conservation areas

There is a total of 2.9 million ha of protected forest and low-productive land in Finland. This consists of 2.4 million ha of statutory PAs and 0.5 million ha of biodiversity conservation sites in commercial forests. Nature conservation in Finland is based on statutory conservation programmes specific to habitat types. National parks and nature reserves are the backbone of the conservation programmes. In 2019, there were 40 national parks and 19 nature reserves with a total area of 1 million ha. These have been complemented with special conservation programmes for peatlands, herb-rich forests, old-growth forests, wetlands, shoreline areas and esker formations. The smallest sites are protected under separate conservation decisions (Ministry of the Environment, 2022). The preservation of wilderness areas in Lapland is secured by the Wilderness Act[59] (1991). Furthermore, the European Commission's Natura 2000 network includes 1 865 protected sites in Finland[60], totalling 5 million ha.

These areas account for 10 percent of the total forest and low-productive land area. As such, most of the protected forest and low-productive land area is in Northern Finland. The history of human influence on Finland's forests is long and varied, and as a result large forests in a natural state occur practically only in certain protected areas in the most northern part of Lapland and in eastern Finland.

Valuable habitats

Since 1997, the Finnish Forest Act has contained definitions of habitats of special importance that must be protected. In 2019, it was estimated that there were 122 000 sites of special importance covering about 70 000 ha.

Voluntary METSO programme[61]

The main flaw in the forest conservation area network is the low number of protected habitats in the southern part of Finland, where only 2.6 percent of forest land is strictly protected. In recent years, the protected area has been increased by the METSO programme, which will continue until 2025. From 2008 to 2019, the programme has resulted in 73 530 ha of new PAs, mainly in privately owned forests, amounting to 76 percent of the programme's target. Sites protected under the programme may remain in private ownership or be sold to the State. METSO's goal is to establish new PAs

[59] www.ecolex.org/details/legislation/wilderness-act-621991-lex-faoc143332/
[60] www.ymparisto.fi/en-US/Nature/Protected_areas/Natura_2000_areas_in_Finland
[61] https://mmm.fi/en/forests/biodiversity-and-protection/metso-programme

and to safeguard biologically diverse sites on private land through environmental agreements and management prescriptions (Koskela *et al*., 2020).

Threatened species and habitats

Since the 1990s in Finland, there has been a significant advance in the research on forest species, and the interaction between forest management and species populations. The occurrence of threatened species is monitored regularly. Finland's fifth assessment of threatened species was completed in 2019[62]. Of the approximately 22 400 species it examined, 11.9 percent were identified as threatened (2 667 species). Nearly one third of the endangered species live primarily in forests (833 species). Of the forest species examined, 9 percent were identified as threatened, including mainly beetles, hymenopterans[63], lichens and fungi. Changes in forest habitats and the closure of open areas are the major threats (Hyvärinen *et al*., 2019). In addition to species, an assessment of threatened habitats has been made. According to the latest assessment of threatened habitats published in 2018,[64] three quarters of the 34 forest habitats and slightly more than half of the mire types were assessed as threatened (Kontula and Raunio, 2018).

Endangered species protection in forest management

In Finland, endangered species protection falls under the Nature Conservation Act, and has been included in Finnish PEFC forest certification requirements from its beginning in 2000: "The known habitats of endangered species shall be safeguarded." Accordingly, "Forest management procedures shall safeguard: a) the previously known habitats of strictly protected species that are demarcated and informed to the land owner/manager by the Centres for Economic Development, Transport and the Environment (ELY centres); b) breeding and resting areas of animal species of Annex IV (a) of the Directive on the conservation of natural habitats and of wild fauna and flora; c) the previously known habitats of other endangered species according to the approach stipulated in the "Protection of Endangered Species in Forest Management".[65]

In the first Finnish FSC forest management standard, protection is defined as follows:

- The forest owner shall acquire information of, and record in the management plan or otherwise document, the occurrences of nationally and regionally threatened species known to the Finnish Environment Institute (Hertta database)[66], the ELY Centres or the Finnish Forest Centre.
- The obligation to acquire information applies to observations made after 1990 and documented with sufficient accuracy.
- The information shall be updated at least when the management plan is revised.

[62] www.environment.fi/redlist

[63] https://en.wikipedia.org/wiki/Hymenoptera

[64] www.ymparisto.fi/en-us/nature/Natural_habitats/Assessment_of_threatened_habitat_types_in_Finland/Assessment_of_threatened_habitat_types_in_Finland_2018

[65] http://pefc.fi/wp-content/uploads/2016/09/PEFC_FI_1002_2014_Criteria_for_Forest_Certification_20141027.pdf

[66] www.syke.fi/en-US/Open_information/Open_web_services/Environmental_data_API

- The forest owner shall secure the protection of habitats of known occurrences of nationally and regionally threatened species if the threat is due to forest management.

As forest certification covers nowadays about 80 percent of Finnish forests, these requirements are very widely known and followed in everyday forestry. In Finnish forestry, a voluntarily based approach "Protection of Endangered Species in Forest Management" was established in 2010 and is now under review, as the Nature Conservation Act is being revised, with the intention to include forest owners who have not certified their forests (Tapio Ltd, 2021).

3.3. FOREST BIODIVERSITY AND CLIMATE CHANGE

In northern latitudes, near the North Pole, the speed of warming is three times faster than the global average. Hence, climate change is predicted to change Finland's forests. A warming climate is likely to increase tree growth, but at the same time the likelihood of severe events, such as droughts and floods, as well as other causes of forest damage will also increase. In Finland, climate change does not threaten the existence of forests, but it is predicted to have strong impacts on forest ecosystems. The more diverse the forests, the better they are expected to adapt to a changing climate. Therefore, the importance of good forest management and the adaptation of forest management practices to the changing climate, for example, in relation to protecting and enhancing biodiversity, are essential (Saksa, 2020).

3.4. INDIGENOUS PEOPLES, FORESTS AND BIODIVERSITY MANAGEMENT

Indigenous Peoples and their rights

The Sámi are Indigenous Peoples recognized by the UN, the European Union and Finland. The Finnish Sámi are divided into Inari, Skolt and Northern Sámi language groups. They exercise land use rights and self-government in their homeland in northern Finland (in the municipalities of Enontekiö, Inari and Utsjoki, and in the northern part of the municipality of Sodankylä in Lapland). Reindeer husbandry and reindeer herding belong not only to Sámi culture, but also to the economic life of others in northern Finland. The Sámi often feel that forests and forestry threaten their traditional livelihoods, such as reindeer herding. According to the law, Metsähallitus should take special consideration of the Sámi in its activities and negotiate with them on forestry measures in the Sámi homeland[67]. The Sámi Parliament[68], the Skolt Sámi Siida Council[69], and the reindeer herding cooperatives represent the Sámi in local and political decision-making. Several Sámi organizations have proposed strengthening tenure rights to state lands, and these processes are ongoing (Carstens, 2016).

Around 90 percent of the area of the Sámi homeland is state land and 72 percent of these state lands are protected and managed by Metsähallitus' Nature Services. About 13 percent are natural economic areas managed by real estate development,

[67] https://forest.fi/article/metsahallitus-beats-the-state-of-finland-in-promoting-forest-biodiversity-and-sami-culture/#886d24ea
[68] www.samediggi.fi/?lang=en
[69] www.kolttasaamelaiset.fi/en/skolt-sami-culture

where forestry is not conducted. About 10 percent of the area of the Sámi homeland is private land, including both Sámi and Finnish owners.

Interactions between forestry and reindeer herding

About 65 percent of the reindeer herding area, which is larger and comes further south than the part belonging to the Sámi homeland, is forest land covered by forestry activities. The planning and implementation of forestry in this area needs to take into consideration the needs of the reindeer herding, as logging affects reindeer pastures in many ways. However, reconciling the needs of forestry and maintaining important pastures for reindeer husbandry is not always easy (Turunen *et al*., 2020).

3.5. INSTITUTIONAL ARRANGEMENTS FOR BIODIVERSITY AND FORESTRY

Ministries

The highest forest authority in Finland is the Ministry of Agriculture and Forestry[70], whose mandate is to create conditions for the sustainable and diversified use of renewable natural resources and to secure the quality of the commodities obtained from them. The Department of Forestry in the Ministry is charged with directing and developing forest policy in Finland. In addition, the Ministry of the Environment[71] is the highest authority in Finland concerning the climate, communities, built environment, housing, biodiversity and sustainable use of natural resources, and environmental protection. Thus, although biodiversity and forest management sit in different ministries, there is active cooperation, with both ministries participating and financing each other's activities and programmes. Both the Ministry of Agriculture and Forestry, and the Ministry of the Environment are together responsible for the performance guidance of Metsähallitus, who manages State forests.

In addition, the Forest Council[72] is a governmental body formed by representatives of different forest user groups, whose task is to support the Ministry of Agriculture and Forestry in important forestry policy topics. The Forest Council also acts as a collaboration forum between the public administration and the private sector. The chairperson is the Minister of Agriculture and Forestry, the vice-chairperson is the Minister of the Environment and, in the Council, there is also a representative of the Ministry of the Environment. The Roundtable on Forestry[73] was established in 2016, and in total 30 organizations from forestry and nature protection participate to discuss the sustainability of forest use, especially from a forest biodiversity point of view. The aim is to find new methods for safeguarding forest biodiversity.

The Finnish State also has its own consultants and expert organizations, two of which are serving both the Ministry of the Environment and Ministry of Agriculture and Forestry, namely the Finnish Environment Institute and Tapio Ltd.

The Ministry of the Environment and Ministry of Agriculture and Forestry have formed several joint cooperation groups. A good example, the Finnish Expert Group

[70] https://fundit.fr/en/institutions/ministry-agriculture-and-forestry-finland-maf
[71] https://ym.fi/en/ministry
[72] https://mmm.fi/en/nfs
[73] https://forest.fi/article/ministers-round-table-to-improve-forest-biodiversity/#2b6845f4

for Forest Restoration[74], established as a part of the Finnish Board on Ecological Restoration, concentrates on issues related to ecological management and restoration of forests in protected areas. Ecological management of forests here refers to maintaining special habitats, like herb-rich forests or sunlit esker forests, as suitable habitats for species requiring protection. Ecological restoration of forests, in turn, aims at recreating structural and other conditions of forests as close as possible to the natural state that prevailed before the forest was utilized for wood production.

At the regional level, the Finnish Forest Centre (Ministry of Agriculture and Forestry) is responsible for promoting sustainable forest management, protecting forest biodiversity and promoting other activities within the forest sector. Meanwhile, the Centre for Economic Development, Transport and the Environment (Ministry of the Environment) promotes regional development, including responsibility for the environment and natural resources. These two organizations cooperate in many areas.

The Finnish Parliament is re-elected every four years and the Finnish government is rebuilt. Depending on the party allegiances of the Minister of the Environment and Minister of Agriculture and Forestry, and the programme of the Government, the cooperation between Ministries can be smooth or not.

3.6. EXPERIENCES OF BIODIVERSITY MANAGEMENT IN FORESTS

Biodiversity and forest ownership

Biodiversity management does not vary much between private forests, forests owned by forestry companies or institutional investors, municipalities, parishes, in joint ownership or in the ownership of other small organizations, or by the Finnish state, because all forest and nature management activities in Finland are subject to the same legal requirements. There is also a common willingness to consider biodiversity management as a normal part of forest management among forest owners and people working in the forestry business.

Nonetheless, some differences in biodiversity management among ownership classes arise from the number of decision-makers. As in Finland there are about 650 000 private forest owners, the range of outcomes is wide. Quite a large number of owners do not manage their forests at all and these revert to a natural state over time. In contrast, in company-managed forests there are only one or few decision-makers and the management procedures are more uniform. Second, global trends and market demands influence forest owners' decisions. Sustainability criteria and forest certification force the biggest forest owners, especially those who are operating in international market-places, to put more effort into biodiversity management.

Metsähallitus Forestry Ltd manages state-owned productive forestry land. The law relating to Metsähallitus states that it "must adequately consider the protection of biodiversity and its appropriate improvement when setting goals for the management, use and protection of forests". The law thus sets a higher level of biodiversity protection for Metsähallitus than for private forest owners. Forestry

[74] www.metsa.fi/en/nature-and-heritage/habitats/finnish-board-on-ecological-restoration-fber/fber-forest-group

operations are based on the principle of multiple forest use. In addition, landscape-based and participatory planning concepts apply during the natural resource planning process, which is also applicable to forest operations. Metsähallitus has voluntarily set aside 385 000 ha of productive forest, while the Parks and Wildlife unit of Metsähallitus manages PAs, recreation areas and cultural heritage sites owned by the state.

3.7. REFLECTIONS ON BIODIVERSITY MANAGEMENT IN FINNISH FORESTS

Positive experiences

- There is a significant increase in the proportion of birch (*Betula pendula* and *B. pubescens*) and other broadleaf species in Finnish forests according to National Forest Inventories[75].
- The volume of deadwood is increasing in southern Finland, according to National Forest Inventories. Deadwood is one of the most important resources for threatened species in Finnish forests.
- The extent of statutory PAs has increased.
- There has been an increase of valuable habitat protection on a voluntary basis via for example the METSO programme and FSC certification.

Neutral experiences

- Among the studied forest species, the proportion of threatened species has not changed over the past 10 years. Most of these species are beetles, hymenopterans, lichens and fungi.

Negative experiences

- Extensive peatland ditching, especially from the 1960s to 1980s, both for agriculture and to improve tree growth for forest land, has had a negative impact on peatland biodiversity and aquatic ecosystems. Both organic soil and nutrient leaching have altered the normal functioning of aquatic ecosystems.
- Wood from these drained peatlands is needed for industry use, but this creates challenges in managing ditched areas to avoid increasing GHG emissions.
- According to the Assessment of threatened habitat types[76], the number of threatened habitats is increasing. In 2018, three quarters of the 34 forest habitats and slightly more than half of the mire types were assessed as threatened.
- Data indicate that in private forests the level of safeguarding biodiversity decreased in forest harvesting operations during the 2010s compared to the 2000s.

To be improved in the future

- Mainstreaming of biodiversity in Finnish forestry is still incomplete. A large proportion of forest owners do not appreciate the importance of operational measures for enhancing biodiversity. A small proportion of forest professionals

[75] https://mmm.fi/en/forests/forestry/forest-inventories

[76] www.ymparisto.fi/en-us/nature/Natural_habitats/Assessment_of_threatened_habitat_types_in_Finland/Assessment_of_threatened_habitat_types_in_Finland_2018

also tend to minimize the importance of biodiversity.
- There is a need for further development of forest certification schemes. The distribution of incentives and costs between participants needs improving. The challenge is also to develop a range of different measures applicable to different circumstances.
- Adaptation to climate change needs greater effort. Ecosystem resiliency is the key for adaptation to future conditions, especially when here in northern latitudes, closer to the North Pole, the speed of warming is three times faster than the global average.

3.8. MAIN FINDINGS AND LESSONS LEARNED

Legislation

- Forest regeneration after logging has been compulsory since 1886 in Finland – i.e. over 130 years. Destroying forests has been illegal.
- Valuable habitat protection has been legislated since 1997. The Forest Act and Nature Conservation Act both safeguard valuable habitats and their biodiversity.
- Finnish biodiversity legislation is among the most demanding and detailed in the world. It is based on science and tailored to the local conditions.

Voluntary measures

- Certified forests cover over 90 percent of the productive forest area in Finland. The most important certification requirements for biodiversity in the Finnish standards are diversified tree species composition, increasing deadwood volumes, and buffer zones along watercourses and around ponds.
- In Finland, there is a long history of using the best practice guidelines for sustainable forest management. Guidelines are prepared in extensive collaboration, involving researchers, forest owners, forest industry, environmental NGOs, and practitioners. The guidelines are continuously updated in order to reflect the most recent scientific knowledge and societal values among the key stakeholders, as well as the main targets set by the Finnish National Forest Strategy. Best practice guidelines include a wide set of actions supporting biodiversity in forestry operations.
- A comprehensive free online service (Metsään.fi) provides up-to-date forest resource information, which is divided into private information for the forest owner and open information available for all. It contains information on valuable habitats and proposals for logging and silvicultural operations.

Funding and value of forests

- Substantial funding to support biodiversity interventions is available generally in society and in commercial forestry. For over 20 years, there has been a market for conserving biodiversity in private forests and through government grants, such as via the voluntary METSO programme where a forest owner can receive

monetary benefits from conserving biodiversity.
- When forests and wood have sufficient economic value, this justifies investment in research, education and other aspects related to forests.

Research, education and cooperation

- Forestry-related training and extension have been organized and offered in a systematic way to forest professionals and forest owners for over 110 years in Finland. High-level education and know-how are available for people working in nature management and forestry sectors.
- There is good cooperation between environmental and forest administration, starting from the ministry level and continuing through to regional and forest site level.

Monitoring

- The National Forest Inventory has been conducted since the 1920s. It provides openly available data about Finnish forests and forest resources. Measurable structural features affecting biodiversity have been included in recent decades.
- Monitoring of forest condition after logging operations is carried out annually through a sample of forest stands by the Finnish Forest Centre, Metsähallitus Ltd and by wood purchasing companies, who organize logging operations.
- There is excellent forest fire control using aeroplanes and other technologies[77] from spring to autumn. Control is helped by easy access to the majority of forests by a dense forest road network.

Ecosystem services

- Among all forms of land use in Finland, forests – i.e. largely commercial semi-natural boreal forests – provide the widest range of ecosystem services, including wood for industry and households, safeguarding biodiversity, absorbing carbon and pollutants from the atmosphere, protecting clean water, preventing erosion, and enhancing recreation and public health.
- In Finland, people have the so-called everyman's right to visit, walk and collect berries or mushrooms in another's forest. Thus, a holistic approach is encouraged towards forest management and the many services they provide.
- The value of ecosystem services is supported through the use of indigenous tree species in Finnish forests, i.e. which comprise a major element on which biodiversity depends if managed appropriately.

[77] www.aerospacetestinginternational.com/news/drones-air-taxis/finnish-researchers-to-test-drones-that-track-forest-fires.html

4. Japan

Tohru Nakashizuka

Forestry and Forest Products Research Institute, Matsunosato, Tsukuba, 305-8687 Japan

4.1. CONTEXT

Forests are the natural climax ecosystem in Japan, except for some extreme environments (e.g. alpine, coastal, among others), and comprise three main forest types: evergreen broadleaf (sub-tropical or warm-temperate), deciduous broadleaf (cool-temperate) and evergreen conifer (boreal) forests, as well as more localized and less widespread forests. With about 66 percent forest cover, the proportion of forested area in Japan has not changed greatly in the past 100 years (Forestry Agency, 2022; Ogura, 2012).

However, the composition of the forest has changed dramatically. Many secondary broadleaf forests, which used to be managed by coppicing[78] to produce charcoal or fuelwood, lost their commercial value because of changing energy demands and were converted into coniferous plantations after 1950 (Iwamoto, 2002). At present, about 40 percent of forested areas in Japan are conifer plantations (Forestry Agency, 2022), while primary natural forests with minimal human impacts were reduced to about 18 percent by 1998, and have been almost stable since (Ministry of the Environment, 2020).

Among the forested areas in Japan, 31 percent are owned by the government (national forests, managed by the Forestry Agency), 12 percent by local governments and 57 percent are privately owned (Forestry Agency, 2022). Most old-growth forests belong to the national forest. The Ministry of the Environment also owns some forested areas, and is concerned with the conservation and management of forests from the perspective of environmental protection.

The issue of ownership greatly affects the biodiversity conservation and management policies for forest ecosystems in Japan. Consultation between the Forestry Agency and the Ministry of the Environment is essential in most cases to establish conservation policies, including the National Biodiversity and Action Plan (NBSAP) 2012–2020[79]. Most of the policies and institutions concerned with biodiversity and ecosystem services target both natural and managed forests, though there is some variation in the proportion of natural and managed forests targeted by different strategies. Here, the systems for managed forests are mainly reviewed,

[78] Coppicing is a traditional method of woodland management which exploits the capacity of many species of trees to put out new shoots from their stump or roots if cut down.

[79] www.env.go.jp/content/900505599.pdf

while only a brief reference is included to the systems for natural or primeval forests. The activities of the private sector are also referred to, since a relatively large effort is made through collaborations among governments (national and local), NGOs and the private sector.

Most of these activities are covered by the Japan Biodiversity Outlook[80] (JBO3 Science Committee, 2021) and NBSAP 2012–2020 (Biodiversity Center Japan, 2021). The Summary for Policy Makers of Japan Biodiversity Outlook has just been published (Ministry of the Environment, 2021a) and a new NBSAP is expected to appear in 2022.

4.2. GOVERNMENT-DESIGNATED AREAS TO CONSERVE BIODIVERSITY AND ECOSYSTEM SERVICES

Concerning the institutions managing land directly for biodiversity conservation, the Ministry of the Environment implements the natural park[81] policy under the Natural Parks Act (2010), while the Forestry Agency manages forest reserves under the National Forest Management Plan (2016). Both institutions target primary or old-growth forests with minimal human impact. In addition, the Ministry of the Environment manages wildlife sanctuaries to regulate hunting or trapping of mammals and birds under the Law on the Protection and Management of Birds and Mammals and Hunting Regulations[82] (2002). As for ecosystem services, the Forestry Agency manages forest areas to conserve ecosystem services following the Forest and Forestry Basic Act (2017).

Natural parks

A system of natural parks was established to contribute to health and recreation by protecting natural landscapes, as well as biodiversity. The Natural Parks Act promulgated in 1957 classifies national parks, quasi-national parks and prefectural natural parks, and they occupy 15 percent of the Japanese territory in total. National parks are established and managed by the national government, while quasi-national parks are established by the national government but managed by prefectural governments. The prefectural natural parks are established and managed by prefectural governments. Natural forests managed by the Forestry Agency account for approximately 60 percent, 45 percent and 25 percent of national parks, quasi-national parks and prefectural natural parks, respectively.

For biodiversity conservation, several levels of protection are applied in the natural parks. In the most strictly protected areas, no silvicultural operations, hunting or non-timber forest product (NTFP) harvesting are permitted, while areas with the least strict protection can be exploited for development through licenses. Strictly protected areas largely include National Forest, such as natural or primeval forests, while the proportion decreases in less strictly protected areas, i.e. notably managed

[80] www.biodic.go.jp/biodiversity/activity/policy/jbo3/generaloutline/files/JBO3_pamph_en.pdf
[81] www.env.go.jp/en/nature/nps/park/doc/files/parksystem.pdf
[82] www.env.go.jp/en/nature/biodiv/law.html

forests and plantations.

Protected forests

Protected forests are a category of National Forest which are managed for the protection of forest ecosystems, wildlife and genetic resources, as well as research and development of technology for forest management. Protected forests include 661 sites covering 978 000 ha (2.6 percent of the country and 13 percent of national forests), though some forest areas are also included in national parks or other protection schemes (Forestry Agency, 2022). Protected forests include three categories: forest ecosystem protection area; protection forest for populations of wildlife; and protection forest for populations of rare species. Forest ecosystem protection areas are at least 2 000 ha, while other categories can be smaller. Most protected forests are old-growth forests, but these can include some planted forests (for genetic conservation) and forests with some operations (for developing research or technology). UNESCO World Natural Heritage Areas (Shirakami-Sanchi, Yakushima, Ogasawara Islands and Shiretoko)[83] are usually included in the forest ecosystem protection areas. Few activities are permitted in forest ecosystem protection areas, while some interventions, mostly for disaster risk reduction or forest restoration, can be conducted in protection forest for wildlife. In comparison, some active interventions may be needed to maintain populations of targeted species in the rare species protection forests. There are 533 sites of protection forest totalling 40 000 ha for rare species, which mostly target tree species but also includes a few herbaceous species and animals.

To enhance conservation, the Forestry Agency has an additional Green Corridor strategy to connect forest reserves. It aims to conserve isolated populations of plants and wildlife, genetic diversity and biodiversity by connecting the protected forests. The green corridors cover 584 000 ha, including plantations and managed forests. Some interventions, including the diversification of stand structure and species composition and facilitating the growth of understorey vegetation, are conducted as needed in the green corridors.

Wildlife protection areas

Wildlife protection areas were established following the Law on the Protection and Management of Birds and Mammals and Hunting Law, which was designed for the protection, breeding, but also population control of wild birds and mammals. Wildlife Protection Areas[84] are designated by the Ministry of the Environment (i.e. national wildlife protection areas) and prefectural governments (i.e. prefectural wildlife protection areas). Protection areas cover 3.06 million ha (8.4 percent of the country) and include all types of terrestrial ecosystems (Ministry of the Environment, 2020). They are categorized into forested habitat (1.77 million ha, i.e. the largest proportion), large-scale habitat, important landing habitat for birds, important breeding habitat, habitat for rare species, habitat corridor, and urban habitat. Some of them overlap with natural parks and other protected area designations.

[83] https://whc.unesco.org/en/list/?search=japan&order=country&type=natural
[84] www.env.go.jp/en/nature/npr/ncj/section6.html

In the sanctuaries, the hunting or capture of birds and mammals without permission is prohibited. After the revision of the law in 2007, measures to manage and control populations were included, particularly in response to overpopulation of certain mammals and birds, such as sika deer, wild boar and the Japanese cormorant[85]. In the areas of strict protection, the installation of buildings and other structures, landfill or reclamation, and logging of trees or bamboo are prohibited without advanced permission.

Protection forests for ecosystem services

Protection forests for ecosystem services are forested areas designated by the Ministry of Agriculture or prefectural government to maintain ecosystem services by regulating logging, construction or topographical change. Among the total of 13 million ha of protection forests that make up 49 percent of the forest area in Japan, 57 percent belong to national forests. These areas are sometimes designated also as a part of national parks or other protected areas. In the protection forests, logging or mining require permission from the prefectural government.

Protection forests for ecosystem services are divided into 17 categories according to the ecosystem services targeted[86] : 1) headwater conservation; 2) soil run-off prevention; 3) hillside failure prevention; 4) sand shift prevention; 5) windbreak; 6) flood damage mitigation; 7) high tide and salty wind damage mitigation; 8) drought prevention; 9) snow-break; 10) fog inflow prevention; 11) avalanche prevention; 12) rockfall prevention; 13) fire spread prevention; 14) fish breeding; 15) navigation landmark; 16) public health; and 17) landscape conservation. Among them, forests for watershed conservation occupy 9.2 million ha (71 percent of the total regulated forests) and those for erosion control occupy 2.6 million ha (20 percent) (Forestry Agency, 2022).

4.3. OTHER STRATEGIES FOR PROMOTING BIODIVERSITY CONSERVATION AND ECOSYSTEM SERVICES

Managed forests and *satoyama* landscapes

Satoyama was originally a word meaning the forests close to a community, an antonym to *okuyama* which means the forest far from the village. As such, *satoyama* was utilized for the production of timber, fuelwood or charcoal, and building materials, while *okuyama* was the forest where people hunted or harvested NTFPs. In recent years, *satoyama* has come to mean a traditional landscape ecosystem mosaic, comprising forests, farmland, paddy fields, and freshwater streams and ponds (Takeuchi, Ichikawa and Elmqvist, 2016). These ecosystem mosaics have been used by the local people in a relatively sustainable manner for hundreds of years.

Forests in *satoyama* landscapes are mostly managed forests, including plantations and secondary forests. Conifers such as sugi (*Cryptomeria japonica*), hinoki (*Chamaecyparis obtusa*) and matsu (*Pinus densiflora*) are planted and used for

[85] https://ec.europa.eu/environment/nature/cormorants/management_japan.htm
[86] https://montreal-process.org/documents/publications/general/2019/3rdCountryreportto-theMP.pdf

timber, while oaks (*Quercus* spp.) were commonly coppiced to produce fuelwood and charcoal. In the traditional management of coppice forests, trees were harvested every 10-20 years, and leaflitter and shrubs were collected every year to make compost. These relatively young forests with a clear forest floor provided a special habitat for plants and animals who depend on such an environment. After the 1950s, however, coppice forests lost their value because of a switch to electricity and were mostly converted into conifer plantations. After 1980, the remaining coppice forests were abandoned and typically grew into older broadleaf forests with a thick undergrowth. As a result, relatively old forests, with low levels of light penetrating to the forest floor, support a reduced diversity of insects and plant species in the understory (Taki *et al*., 2010).

Conifer plantations used to be managed intensively, requiring planting, weeding, thinning and logging, in order to produce high quality timber. However, after the tax on imported timber was removed in the 1950s and with increasing labour costs, domestic timber became uncompetitive and forest management has gradually declined. With the cessation of management in many plantations, the trees became overcrowded, casting deep shade, and without undergrowth the forest floor becomes vulnerable to erosion. In contrast, plantations with appropriate management can maintain some undergrowth, including rare species (Igarashi and Kiyono, 2008).

These changes in forest management caused serious impacts on biodiversity. Likewise, other changes in *satoyama* landscapes, mainly involving simplification of the agricultural environment and increased use of agricultural chemicals, have occurred in parallel, with many species that used to be very common becoming endangered. This situation is recognized as a biodiversity crisis in the Japanese National Biodiversity and Action Plan (NBSAP), including in relation to *satoyama* landscapes[87].

Strategies to conserve biodiversity in managed forests and *satoyama*

Since a large part of managed forests are owned privately, biodiversity conservation in these forests is implemented differently from the designation of protected areas. In many cases, conservation needs also to be considered at the landscape level rather than just in forest management, since many species depend on multiple ecosystems and their mosaic structure (Kadoya and Washitani, 2011). Hence, in some cases, conservation activities involve the management of agricultural fields, wetland and freshwater ecosystems, together with forests.

Activities to conserve biodiversity in *satoyama* are supported by various stakeholders. Local people and NGOs often raise concerns about the biodiversity and ecosystems in an area, and participate in conservation activities. National and local governments arrange subsidies, and sometimes coordinate activities, while businesses may provide funding or participate in the activities as stakeholders.

[87] https://satoyama-initiative.org/featured_activities/nbsap-research

Forest certification

Aside from the national standard under the Forest Stewardship Council (FSC)[88], a Japanese certification system called the Sustainable Green Ecosystem Council (SGEC) was established in 2003 and was endorsed by the Programme for the Endorsement of Forest Certification (PEFC)[89] in 2016. By 2021, 2.15 million ha (9 percent of forests in Japan) were certificated by SGEC, with another 0.42 million ha (2 percent) certified by FSC (Forestry Agency, 2022).

In the certification criteria for SGEC, with respect to biodiversity conservation, primary forests should not be converted to planted forests except in exceptional circumstances. In addition, flora and fauna of conservation importance in the target area should be recorded. In particular, endangered species should be listed, and their habitat protected based on a biodiversity conservation plan. Furthermore, the risk of introducing alien species should be carefully considered and monitored so as to avoid adverse effects.

Unfortunately, there is not much of a premium for certified timber, although forest management is costly in Japan. Hence, there is little incentive for forest owners to obtain certification and the proportion of the certified forests remains low (Sugihara and Oki, 2018). Nevertheless, in some municipalities, the local governments require contractors to use certified local timber under publicly- funded projects or pay a subsidy to people who use certified timber to build their houses (Yusuhara Town, 2017)[90].

CO_2 credits

Carbon credits are helpful in providing funding to compensate for sustainable forest management costs and are sometimes linked with forest stewardship. J-Credit is a system authorized by the Japanese government (J-Credit Secretary, 2013). In the case of forest-derived credits, forestry corporations and other organizations register the amount of CO_2 sequestered through sustainable forest management, such as thinning to promote forest growth, as credits that can be sold to companies. The income earned from the sale of credits will be used to cover forest management costs, and a part will be returned to the forest owners. Thus, the credit mechanisms can be an incentive for forest owners to enhance biodiversity conservation through sustainable forestry operations.

Forest environment tax or water conservation tax

Since 2003, some prefectures have started to collect environmental taxes, called the forest environment tax or water conservation tax. Through these taxes, local people pay for the ecosystem services of forests, such as water conservation, erosion control and biodiversity conservation. By 2016, 37 out of 47 prefectures in Japan were collecting JPY 300–1 200 (about USD 3–10) per person per year, and using the money for improved forest management, mainly for thinning over-crowded plantations, but sometimes including specific interventions for biodiversity conservation, including

[88] https://fsc.org/en/document-centre/documents/resource/460
[89] www.pefc.org/discover-pefc/our-pefc-members/national-members/sgec-pefc-japan
[90] www.gov-online.go.jp/eng/publicity/book/hlj/html/202107/202107_04_en.html

satoyama activities (Takahashi and Tanaka, 2021).

In 2019, the Forestry Agency introduced a new nationwide tax called the forest environment tax. The government collects JPY 1 000 per person per year, and the money is delivered to the prefectures, and finally to municipalities to support forest management activities. As such, municipalities decide how to spend the funds according to their forest management plans. However, some small municipalities do not have enough human resources to make effective forest management plans (Kohsaka and Uchiyama, 2019).

Law for the Promotion of Nature Restoration

In 2002, the Japanese government passed the Law for the Promotion of Nature Restoration (2002),[91,92] aiming to support conservation or restore degraded ecosystems through collaboration among national and local governments, local people, NGOs and scientists (Watanabe, Okuyama and Fukamachi, 2012). To obtain governmental support, stakeholders must establish a nature restoration committee and develop an implementation plan for target areas. As such, the implementation plan should include scientific reviews with monitoring activities based on adaptive management. Target areas are also expected to be used as sites for nature education. So far, several tens of projects have been supported by various ministries (Ministry of the Environment; Ministry of Land, Infrastructure, Transport and Tourism; and Ministry of Agriculture, Forestry and Fisheries), targeting various ecosystems, not only forests. Managing alien species in Ogasawara World Heritage Area is one such example[93].

Corporate forests

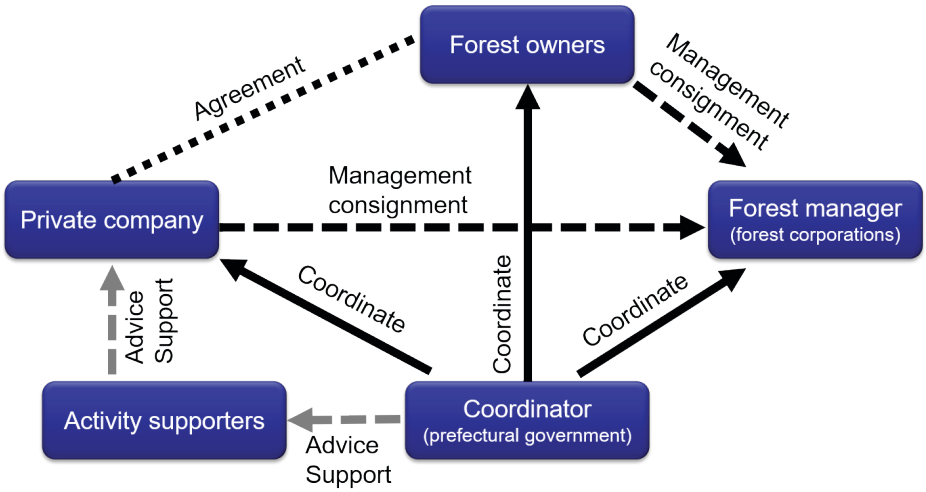
The Forestry Agency has a collaborative scheme with private companies for forest management in national forests (Forestry Agency, 1993), referred to as corporate forest (Houjin-no-Shinrin). In this scheme, the Forestry Agency provides land for plantations or young forests, which need to be managed for decades, while the private company provides the funds necessary to manage the forest until ready for harvesting. As a result, the Forestry Agency and the company share the income from harvesting the timber. Private companies also can use the forest for other activities, such as environmental education, including employees, clients or local people gaining experience of forest practices. The activities are sometimes evaluated, as well as the performance of the ecosystem services provided (carbon sequestration, water conservation, soil conservation, and biodiversity conservation, among others). Thus, private companies can use this system for corporate social responsibility (CSR)-related activities. By 2016, 2 355 ha of national forests were under this type of contract.

[91] www.fao.org/faolex/results/details/en/c/LEX-FAOC050709
[92] www.env.go.jp/en/nature/npr/nrp_japan/pdf/50_overview.pdf
[93] http://ogasawara-info.jp/en/sizenwomamorutorikumi/sizenwomamorutorikumi.html

Prefectural support for corporate afforestation

Prefectural governments also have a scheme to support collaboration between private companies and other sectors, referred to as forest supported by private companies (kigyo-no-mori). This scheme includes nature parks or regulated forests owned by prefectures or municipalities and the aim is to enhance ecosystem services. In addition, this approach is applied to forests owned by municipalities or private owners in order to improve forest management. In this collaboration, private companies provide the necessary funds, while forestry corporations, NGOs and municipalities coordinate activities and develop a management plan. As a result, the corporate employees and other citizens participate in activities, such as planting trees, thinning, environmental education, and so on. Carbon sequestration and other ecosystem services are also quantified in order to evaluate the progress of the project (Mori-navi Management Office, 2021; **Figure 1**). Though the areas for actual operations are usually not very large, the system works to enhance mainstreaming of biodiversity conservation, especially by including multiple actors.

FIGURE 1.
Typical scheme for the collaboration among multiple stakeholders or actors through the Kigyo-no-Mori scheme.



Source: Mori-navi Management Office. 2021. Kigyo-no-Mori (in Japanese). www.morinavi.com/support/support-tokyo.html

Support for *satoyama* activities

There are many public and private agencies, including through private company CSR budgets, which provide funds for *satoyama* management activities or managed forests (Mori Dukuri Forum, 2021). As such, many local community groups and NGOs try to obtain funding from these agencies to maintain their activities.

4.4. EXAMPLES OF MAINSTREAMING BIODIVERSITY CONSERVATION IN MANAGED FORESTS

Environmental icons to promote forest management and local industries

The golden eagle (*Aquila chrysaetos*) is an endangered species in Japan whose breeding success has declined, because of the decrease in food resources and its hunting ground, including through the replacement of natural forests and open areas with monoculture plantations that support little biodiversity (Ogden *et al.,* 2020)[94]. Moreover, the decline of the forest industry in Japan has increased rotation lengths, and the proportion of young forests and open sites is very low. These conditions have negatively impacted populations of hares, pheasants and other small animals that prefer open habitats. Hence, the promotion of appropriate forest management activities can have a positive effect for golden eagles, especially with participation of local communities[95].

A Japanese baseball team named the Tohuku Rakuten Golden Eagles uses this species as the team mascot. The baseball team and the host company established a fund from sales and some voluntary contributions to support forestry activities to enhance the breeding of golden eagles. Local government, the Forest Agency and local forest corporations collaborated to revitalize forest management practices in the target area, including thinning of forest plantations to create a mosaic of open areas and young forest stands that provide suitable habitats for prey species (Rakuten, 2015).

Similar approaches, using some animals or plants as environmental icons to revive or promote sustainable forest management, have been increasing in many *satoyama* areas in Japan. For example, some beautiful butterfly or plant species that require a coppice system, i.e. a traditional method of woodland management, to maintain their populations are used as icons for conservation activities (Spake *et al.,* 2019). Likewise, the crested ibis (*Nipponia nippon*) (Sado City, 2021) and the oriental white stork (*Ciconia boyciana*) (Toyooka City, 2019) are famous examples[96]. These two bird species were once locally extinct and the Ministry of the Environment, prefectural governments and municipalities wanted to restore their populations. As their habitat requirements include paddy fields and wetlands, as well as forests, local farmers were requested to join the movement to revive traditional cultivation systems and reduce chemical inputs. Though such traditional farming was costly, the rice branded by these icons[97] sold better than before and thus succeeded in creating benefits for the farmers, as well as for biodiversity.

Conservation of ecosystem services of shared importance

As an example, a beverage maker wanted to secure high-quality water, and so started to enhance ecosystem quality in its watershed (Kyowa Kirin Co., Ltd., 2021). The

[94] https://e360.yale.edu/features/for-japans-eagles-hope-lies-in-rewilding-long-tamed-forests
[95] www.gov-online.go.jp/eng/publicity/book/hlj/html/201811/201811_03_en.html
[96] www.biodic.go.jp/biodiversity/shiraberu/policy/pes/en/satotisatoyama/satotisatoyama02.html
[97] https://visitkinosaki.com/things-to-do/stork-natural-rice

company rented the forests from owners, including the Forestry Agency (following the corporate forest schemes), and started afforestation and forest management activities. Collaborating with NGOs, forest corporations and local citizens, the activities included forest management to enhance water resources, biodiversity conservation and traditional culture. Other brewery companies have made similar investments to conserve forests in order to maintain water quality and collaborate with local people to raise awareness about water conservation, as water is an essential ingredient for their commodities.

Forest management to avoid ecosystem disservices[98]

Overpopulation of sika deer (*Cervus nippon*) in recent decades has caused serious problems for agricultural and forest productivity, and sometimes resulted in soil erosion. Some prefectures have started to use the forest environment tax to fund countermeasures against deer. These include the establishment of fences to exclude deer or culling the populations through collaboration with NGOs, forestry corporations, hunting associations and local citizens (Kanagawa Prefecture, 2021).

Another example is reducing invasive bamboo populations. These bamboo species (*Phyllostachys bambusoides* and *P. pubescensheterocycla*) were introduced into Japan hundreds of years ago, but were utilized traditionally. However, their use has declined greatly in recent years, and consequently their populations have increased and invaded farmlands and forest ecosystems (Isagi and Torii, 1997). Thus, conserving *satoyama* landscapes often involves bamboo control. For example, new ways to utilize bamboo (e.g. for making charcoal or handicrafts) have been tried with the collaboration of local governments, NGOs, and citizens (Ministry of the Environment, 2021).

4.5. CONCLUSIONS AND LESSONS LEARNED

Conservation areas for biodiversity and ecosystem services have been defined throughout Japan, though they tend to be concentrated in national forests or prefectural forests, since by definition they limit private rights, whereas a large part of the managed forest estate is under private ownership. Moreover, given the history of forest management in Japan, designating areas for protection or preservation may not be effective for biodiversity conservation in many cases. As such, many managed forests need some treatment for both production and conservation purposes.

Since the domestic timber price is not competitive with imported timber, many private forest owners need subsidies to conduct operations. Thus, subsidies combined with payments for ecosystem services (PES) could work to promote both forestry and biodiversity conservation. In addition, requirements to use certified timber for government construction programmes or bioenergy could be effective.

Several strategies to facilitate biodiversity conservation have been initiated and many of them encourage the participation of various stakeholders or actors, including business sectors. Strategies that create co-benefits among different stakeholders are

[98] "Ecosystem disservices (EDS) are functions or properties of ecosystems that cause effects that are perceived as harmful, unpleasant or unwanted. Examples of EDS include pest damages to agriculture" (Lyytimäki, 2015).

suggested. Some examples propose that corporate social responsibility activities or PES finance could be promising avenues for mainstreaming biodiversity conservation in sustainably managed forests (Ishizaki and Matsuda, 2021). Local people who want to conserve forests need funds for their activities, while some companies or local farmers may want to safeguard water quality or improve corporate image. As such, environmental icons can work to enhance local movements. Nevertheless, local or national governments are required to coordinate activities in order to facilitate improved outcomes for a range of stakeholders.

The examples described here tend to be local, small-scale activities, but have the potential to bring biodiversity conservation into the mainstream. The challenge for Japan is to capitalize on these local efforts by scaling up biodiversity conservation in managed forests across the nation. It will be particularly important to learn from the experiences of various existing projects and design programmes in the future that generate multiple benefits among different stakeholders.

5. Malaysia

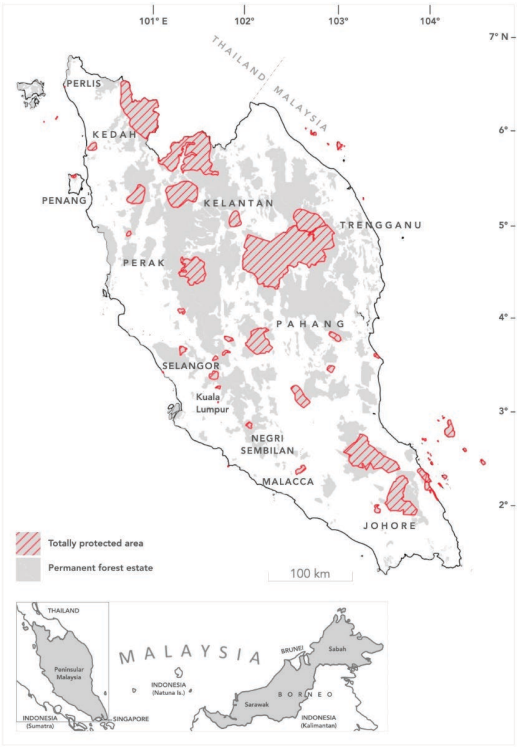
Teckwyn Lim[1] and Rhett Harrison[2]

1. Resource Stewardship Consultants Sdn Bhd (RESCU)
2. CIFOR-ICRAF, 10-12 St Eugene Office Park, Lake Road, Kabulonga, Lusaka, Zambia

5.1. CONTEXT

Malaysia is a federation of 13 states and three federal territories. Eleven states and two federal territories are located in Peninsular Malaysia, covering 13.2 million ha (which accounts for 40 percent of Malaysia's total land area) (**Figure 1**). Malaysia's total population in 2021 was 32.7 million; approximately 92 percent of the population resides in Peninsular Malaysia. The Indigenous Peoples of the Peninsula are the Orang Asli, who number around 140 000 (<1 percent of the population).

FIGURE 1.
Permanent forest estates and totally protected areas in Peninsular Malaysia.



Source: KATS. 2019. A Master List of Protected Areas in Malaysia: A Tool for National Biodiversity Conservation Management and Planning. Putrajaya: Ministry of Water, Land and Natural Resources, Malaysia.

The primary agricultural products include palm oil, rubber, cocoa and rice, while the main industries are rubber and palm oil processing, petroleum and natural gas, light manufacturing, pharmaceuticals, electronics and semiconductors, and timber processing, including sawmills, plywood/veneer mills and wood moulding mills.

Peninsular Malaysia extends 780 km from Thailand to Singapore (6°45' north down to 1°15' north of the equator). It is generally hilly, with eight mountain ranges constituting almost 20 percent of the land area. Almost 90 percent of the water supply for Peninsular Malaysia is derived from these highlands.

In 2020, Peninsular Malaysia was covered by approximately 5.75 million ha of forests (43.5 percent of the total land area; **Figure 1**). Of this, 4.89 million ha is classified as permanent reserved forest[99], of which 2.98 million ha are classified as production forest. In addition, a further 0.59 million ha are protected as national parks and other protected areas (PAs) (**Figure 1**).

Malaysia is one of 17 megadiverse nations that together harbour the majority of the Earth's species and are rich in endemic species. Peninsular Malaysia alone is home to over 8 800 plant species (Saw and Chung, 2007). The main forest types include 4.35 million ha of *terra firma* forest (mostly tropical mixed dipterocarp forest), 0.24 million ha of peat swamp forest, and 0.1 million ha of mangrove forest. These are further divided into 16 forest habitat types (seven elevation-dependent and nine edaphic forest types). The upper montane ericaceous forest occurs on peaks above 1 700 m a.s.l., where the canopy rises to no more than a metre. The lower montane forest is rich in oak and laurel species, as well as other typically temperate shrub taxa. Hill dipterocarp forests range between 300–800 m a.s.l., while lowland dipterocarp forests dominate land up to 300 m a.s.l. The latter habitat has the most diverse array of plant and animal species, with a main canopy around 45 m above the ground and emergent trees reaching over 80 m in height. These forests are known as dipterocarp forests because of the prevalence of canopy trees in the family Dipterocarpaceae, but support a high diversity of tree taxa with over 350 species per hectare. In the coastal plains, peat swamp forest can be found, with acidic soils that are poor in minerals. Along the coast in saline and mineral-rich areas, mangrove forests grow, which are important breeding grounds for coastal fisheries (Symington, 2004).

Around 220 mammal species inhabit Peninsular Malaysia, including threatened large mammals such as the Malayan tiger (*Panthera tigris corbetti*), Asian elephant (*Elephas maximus*), Malayan sun bear (*Helarctos malayanus*) and Malayan tapir (*Tapirus indicus*). The region also contains more than 625 species of birds, 250 species of reptiles, 90 species of amphibians and more than 385 species of freshwater fish. Development has led to the local extinction of several species in Peninsular Malaysia, including the Javan rhinoceros (*Rhinoceros sondaicus*), the green peafowl (*Pavo muticus*) and the banteng (*Bos javanicus*). In addition, the Malayan tiger[100] and other species previously thought to occur in abundance are becoming scarce.

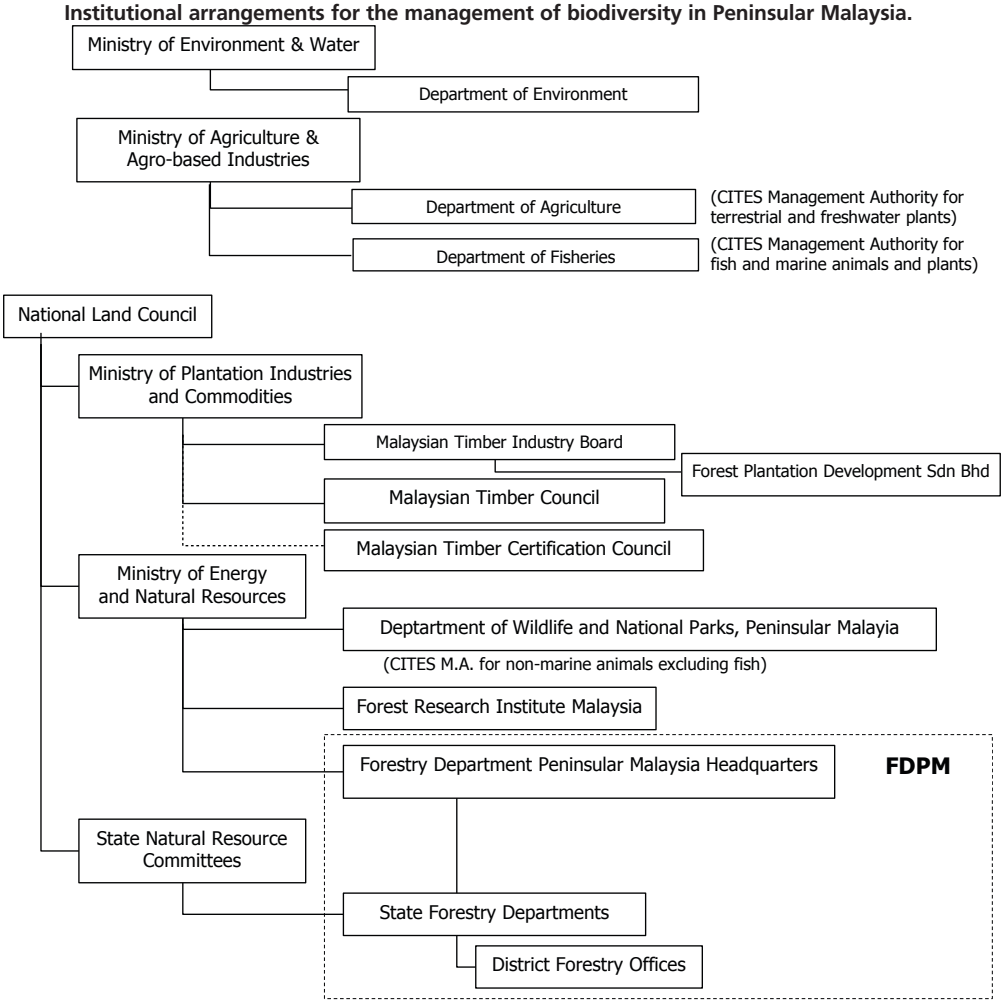
In 1946, forests covered 77 percent of Peninsular Malaysia's total land area. Since then, much of the lowland forest has been converted to agriculture, urban

[99] www.forestry.gov.my/en/2016-06-07-02-53-46/2016-06-07-03-12-29
[100] https://bagheera.com/malayan-tiger

development and other uses. As of 2020, the forest cover stood at 43.6 percent. Forest management in the Peninsula is coordinated by the Forestry Department Peninsular Malaysia,[101] headquartered in Kuala Lumpur. The implementation of forestry activities is carried out by the state forestry departments, which have operational autonomy under their respective state governments (**Figure 2**).

FIGURE 2.

Institutional arrangements for the management of biodiversity in Peninsular Malaysia.


Ministry of Environment & Water
Department of Environment
Ministry of Agriculture & Agro-based Industries
Department of Agriculture
(CITES Management Authority for terrestrial and freshwater plants)
Department of Fisheries
(CITES Management Authority for fish and marine animals and plants)
National Land Council
Ministry of Plantation Industries and Commodities
Malaysian Timber Industry Board
Forest Plantation Development Sdn Bhd
Malaysian Timber Council
Malaysian Timber Certification Council
Ministry of Energy and Natural Resources
Deptartment of Wildlife and National Parks, Peninsular Malayia
(CITES M.A. for non-marine animals excluding fish)
Forest Research Institute Malaysia
Forestry Department Peninsular Malaysia Headquarters
FDPM
State Natural Resource Committees
State Forestry Departments
District Forestry Offices

Source: Authors' own elaboration.

[101] www.forestry.gov.my/en

5.2. POLICY AND LEGAL CONTEXT

Overview

The mainstreaming of biodiversity conservation in production forestry takes place within the context of forest management more generally. In Malaysia, this includes a broad framework provided by Malaysia's international obligations, especially the National Biodiversity Strategy and Action Plan (NBSAP)[102]; the network of PAs; and non-extractive uses of production forests, such as schemes involving payments for ecosystem services (PES).

Policies

There is a comprehensive array of strategies and action plans related to biodiversity conservation in Malaysia as a whole, and for Peninsular Malaysia in particular. The primary document is the National Policy on Biological Diversity 2016–2025 (Ministry of Natural Resources and Environment, 2016). This document provides a framework for the conservation of particular taxa, several of which have dedicated plans of their own, including the National Tiger Action Plan for Malaysia 2008–2020 (DWNP, 2008); the Malaysia National Strategy for Plant Conservation (Saw, Chua and Rahim, 2009); and the National Elephant Conservation Action Plan (DWNP, 2013). Malaysia has repeated its commitments to these national policies by signing international declarations, such as the St. Petersburg Declaration on Tiger Conservation (2010)[103].

In addition to taxa-based approaches, the National Policy on Biological Diversity 2016–2025 is supplemented by plans that promote a spatial approach to conservation. In this regard, the key document is the National Physical Plan (2017)[104], which provides for the connectivity of forest cover in the Peninsula via a scheme known as the Central Forest Spine Master Plan (2010)[105]. This plan situates protected areas (PAs) within a matrix of production forests, all connected by a series of ecological corridors. A comprehensive overview of the PA network is provided by A Master List of Protected Areas in Malaysia (KATS, 2019).

In terms of forest management, the guiding policy is set by the Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021), launched by the Prime Minister on 21 March 2021[106], and including explicit reference to biodiversity and key elements of the NBSAP, such as the Central Forest Spine Master Plan. The policy enshrines a 1992 commitment[107] to keep 50 percent of the nation under forest and tree cover and also makes reference to the SDGs related to forests and biodiversity[108], including a commitment to sustainable forest management (SFM). As

[102] https://asean.chm-cbd.net/documents/nbsap-malaysia
[103] www.iucn.org/sites/dev/files/import/downloads/st_petersburg_declaration_english.pdf
[104] https://myplan.planmalaysia.gov.my/www/admin/uploads_publication/rancangan-fizikal-negara-ke-3-chapter-7-en-31102020.pdf
[105] https://conservationcorridor.org/cpb/Peninsular_Malaysia_Regional_Planning_Division_2009.pdf
[106] www.frim.gov.my/pm-launches-malaysian-forestry-policy-at-kbg-frim
[107] http://gofbonline.com/rainforests-malaysias-story
[108] www.epu.gov.my/en/sustainable-development-goals

a policy document, the Malaysia Policy on Forestry enshrines a strong ambition to protect biodiversity for the future benefit of the nation.

Laws

The legal framework for the management of biodiversity in Malaysia is tied to several international conventions related to the conservation of nature. Malaysia is a signatory to the CBD (1992)[109] and CITES (1973)[110]. Nearly 35 000 species of plants and animals have been accorded protection in the form of regulating international trade in these species. Other relevant conventions that Malaysia has signed up to include the UNFCCC (1992),[111] ITTA (1994),[112] and Ramsar (1971).[113]

In terms of national legislation, the Federal Constitution does not make explicit reference to biodiversity, but provides for the management of forests and wildlife. To take into account the international commitments, the National Forestry Act (1984, s 12 (a)) was amended in 1993[114] to incorporate biodiversity considerations as key criteria for the maintenance of the permanent forest estate. In addition, in 2010 the wildlife laws of the Peninsula were revised as the International Trade in Endangered Species Act (2008)[115] and the Wildlife Conservation Act (2010)[116]. Nevertheless, there are significant gaps (Hamidah *et al*., 2020). There is no law that protects endangered plant species, and the Wildlife Conservation Act only protects endangered animals against hunting, and does not have any provisions to protect the habitats and resources of endangered species. In addition, the laws are not directly linked to threatened status, such as in the Malaysia Red List (Hamidah *et al*., 2020; Yong *et al*., 2021), and hence there are some important omissions in the legal protection, including most non-timber plants.

Practice

Around 59 percent of Malaysia's land cover is forested and the United Nations 2010 target of conserving 10 percent of its land area under strict PAs is exceeded, with 13.2 percent of its terrestrial area declared protected (A Master List of Protected Areas in Malaysia, KATS, 2019). The bulk of production forest is not included in this area as its primary purpose is timber production. However, production forest is acknowledged as contributing to biodiversity conservation under the NBSAP (Ministry of Natural Resources and Environment, 2016). In addition, the Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) refers to the importance of payments for ecosystem service (PES) schemes. In Peninsular Malaysia, one PES scheme is operational and is a component of the Central Forest Spine landscape[117].

[109] www.cbd.int/countries/profile/?country=my
[110] https://cites.org/eng/parties/country-profiles/my
[111] https://unfccc.int/resource/docs/convkp/conveng.pdf
[112] https://enb.iisd.org/ITTC57-International-Tropical-Timber-Council-summary
[113] www.ramsar.org/
[114] www.fao.org/faolex/results/details/en/c/LEX-FAOC033376/
[115] https://cites.org/sites/default/files/projects/NLP/MalaysiaPermitRegulations2008.pdf
[116] www.umlawreview.com/lex-omnibus/10-years-of-the-wildlife-conservation-act-2010-how-it-has-fared
[117] www.ic-centralforestspine.com.my/wp-content/uploads/2021/07/IC-CFS-Project-Document.pdf

Under this scheme, the Perak State Forestry Department negotiated an agreement with a small hydro developer, whereby 0.25 percent of profits are paid to the state forest department in exchange for temporarily protecting the catchment area. In addition, discussions are underway regarding the possibilities for water-based PES in several other key forest sites, such as in the Ulu Muda forests[118] of Kedah State.

5.3. INSTITUTIONAL ARRANGEMENTS

Overview

This section examines the extent to which the policies, laws and practices governing institutional arrangements enable inter-agency cooperation for conserving biodiversity in production forests in Peninsular Malaysia. In the context of the Federation of Malaysia, these institutional arrangements also take into account inter-state cooperation and federal-state cooperation.

Policy

The NBSAP (Ministry of Natural Resources and Environment, 2019) acknowledges the importance of multi-stakeholder cooperation for conserving biodiversity. With respect to forestry, the Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) notes that forest resources shall be "managed through the establishment of strategic partnerships with various stakeholders". For the first time, the policies of the forestry departments of Peninsular Malaysia, Sabah and Sarawak are combined into a unified document that reflects the policies of all the individual states and the federal government. The Malaysia Policy on Forestry also, for the first time, acknowledges the importance of multi-stakeholder initiatives in defining standards for SFM, making explicit mention of both the Malaysian Timber Certification Scheme[119] (coordinated by the Malaysian Timber Certification Council[120], which is accredited by PEFC[121]), as well as FSC schemes[122].

The Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) makes explicit mention of all Malaysia's international commitments related to biodiversity, including the key international conventions. However, in the Peninsula, the responsibility for implementing these conventions is shared between the Forestry Department and the Department of Wildlife and National Parks, while the policy makes limited reference to mechanisms for inter-agency collaboration.

Laws

As noted in the Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021), the Federal Constitution provides for a National Land Council[123]

[118] https://foe-malaysia.org/articles/friends-of-ulu-muda-foum-urge-the-kedah-state-government-to-prioritise-conservation-and-protection-of-ulu-muda-forests-and-develop-other-sustainable-sources-of-revenue/
[119] https://mtcc.com.my/certification-programme
[120] https://mtcc.com.my
[121] www.pefc.org
[122] https://my.fsc.org/en-my
[123] www.constituteproject.org/constitution/Malaysia_2007.pdf?lang=en

to coordinate the policy and practice with regards to forest management among the state forestry departments. In addition, the National Forestry Act[124] (s5, s91, s92)[125] provides for the armed forces and police to assist the forestry department in enforcing the provisions of the Act.

Nonetheless, there are several gaps in the existing legislative framework relating to inter-agency cooperation for biodiversity conservation. In Peninsular Malaysia, the Forestry Department is listed as a management authority for forests, but under the International Trade in Endangered Species Act[126], the management authority for animals is the Department of Wildlife and National Parks, for plants the Department of Agriculture, and for timber the Malaysian Timber Industry Board. However, this act is primarily concerned with international trade and the primary legislation for managing production forestry is the National Forestry Act, which does not have any provision to empower officers from other departments to assist the Forestry Department in managing biodiversity.

Practice

In practice, the institutional arrangements for the management of biodiversity in Peninsular Malaysia involve departments in several ministries (**Figure 2**). In terms of forest management, the state forestry departments are coordinated by the Forestry Department Peninsula Malaysia with overall policy set by the National Land Council.

In addition to these mechanisms for inter-agency planning, the federal government has also launched several inter-agency operational initiatives. In 2014, as part of the National Blue Ocean Strategy[127], an inter-agency platform was launched, known as the Malaysia Biodiversity Enforcement Operation Network[128]. This enforcement network (rebranded as Operasi Bersepadu Khazanah in 2019), includes key enforcement agencies such as the Forestry Department Peninsula Malaysia, Department of Wildlife and National Parks, Customs, Immigration, Police and Army. The network has organized annual integrated forest enforcement activities and has had several successes, including crippling syndicates that were targeting tigers and elephants. In 2020, joint operations resulted in the arrests of 87 wildlife criminals (49 foreign, 33 local), destruction of 460 wire snares and seizures valued at RM 2.7 million (approximately USD 670 000). These efforts have been recognized by the UNEP's Environmental Enforcement Award[129].

Despite the success of the enforcement network, substantial barriers exist to inter-agency cooperation. None of the CITES management authorities have jurisdiction

[124] www.forestry.gov.my/en/perhutanan-negara-1984

[125] Article 91 of the Federal Constitution. Article 91(5): National Land Council makes the national policies for the development and control of the use of land in the whole of the federation for the purpose of mining, agriculture, forestry or for any other purpose.

[126] https://cites.org/eng/parties/country-profiles/my/national-authorities

[127] http://uctc.uthm.edu.my/index.php/national-blue-ocean-strategy-nbos

[128] www.cbd.int/doc/nr/nr-06/my-nr-06-en.pdf

[129] https://malaysia.un.org/en/113011-2020-asia-environmental-enforcement-awards

to carry out enforcement operations within the permanent reserved forests,[130, 131] because operational control over natural resources, including production forests, lies with the state governments. In practice, manpower constraints mean that control of poaching and other enforcement activities within production forests largely depends on the concession holders. Therefore, as only approximately 7 percent of production forests are under active logging licenses at any particular time, this leaves the majority of forests in the Peninsula with limited on-the-ground protection.

5.4. TIMBER CONCESSIONS

Policy

The Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) has numerous policies related to the management of biodiversity conservation in timber concessions in Peninsular Malaysia. The policy promotes the practice of sustainable forest management (SFM), utilizing a silvicultural system known as the selective management system (Kubota *et al*., 2018), which incorporates reduced-impact logging (RIL) verified by independent third-party assessors under the Malaysian Timber Certification Scheme. SFM includes the requirement to identify, manage and monitor high conservation value forest (HCVF)[132], which includes areas that contain endangered, rare and threatened species, riparian buffers, salt-licks and other environmentally sensitive areas.

Laws

The National Forestry Act 1984 includes the requirement that production forests be managed under the principles of sustained yield. However, the SFM policy and its various elements (such as selective felling, RIL and certification) are not explicitly provided for under existing legislation. The Environmental Quality Act (1974)[133] requires that logging operations exceeding 500 ha are subject to an environmental impact assessment (EIA), but does not have explicit provisions related to the conservation of biodiversity. At present, no law explicitly protects endangered species of flora or fauna, or endangered ecosystems, from the effects of logging activities.

Practice

In practice, extensive measures are being taken to conserve biodiversity in timber concessions in Peninsular Malaysia. All timber concessions are subject to the Malaysian Timber Certification Scheme (MTCS) and, to date, all the key forest management units have been certified under this or the FSC scheme (**Table 1**). However, one significant gap in the management of biodiversity in timber concessions involves the conversion of natural forests to timber plantations, which is excluded from certification. Another issue relates to the capacity of local experts to

[130] https://foe-malaysia.org/articles/legal-classes-of-forests-and-conservation-areas-in-malaysia
[131] www.macaranga.org/data-story-peninsular-malaysia-forestry
[132] https://wwfeu.awsassets.panda.org/downloads/hcvffinal.pdf
[133] www.env.go.jp/en/recycle/asian_net/Country_Information/Law_N_Regulation/Malaysia/Malaysia_mal13278.pdf

carry out quality high conservation value (HCV) assessments. At present, there are only two registered HCV assessors in Malaysia.

In practice, the Forestry Department Peninsular Malaysia has a list of 32 tree species that are not to be harvested under SFM (these include CITES species, fruit trees and trees that are utilized by the Orang Asli)[134]. In addition, tree species that are listed as rare, threatened or endangered on the Malaysia Plant Red List (Chua, Suhaida and Aslina, 2012; Chua *et al*., 2010) are protected. One species, *Shorea kuantanensis*, was thought to have gone extinct when its type locality was converted into an oil palm plantation, but fortunately was subsequently found inside a permanent reserved forest (Nasir *et al*., 2017). A total of 1 600 plant species have been assessed and 567 have been classified as threatened, with three or four global extinctions, such as the Ledang fern (*Oreogrammitis kunstleri*)[135] and Penang begonia (*Begonia eiromischa*)[136] (Yong *et al*., 2021). The protection of non-tree plant species has yet to be incorporated into forest management and, under the national CITES system, is the responsibility of the Department of Agriculture.

Forest certification requires that best practices for SFM are implemented and high conservation values (HCVs)[137] are protected. In practice, this means that forest harvesting is appropriately planned and stakeholders, especially Indigenous Peoples, are consulted. Under SFM, foresters are required to maintain a specified number of large (mother) trees per hectare, while hollow trees, fallen logs, and important fruit resources, such as figs[138], are retained. Meanwhile, steep slopes and buffer zones for springs and streams are maintained as set aside. For felling and extraction, loggers must comply with RIL guidelines, such as directional felling and planning of skid trails[139]. Nevertheless, the best practice guidelines (e.g. Kamaruzaman and Wan Ahmad, 2003) could be strengthened by requiring loggers to use minimum disturbance techniques, and a number of stakeholders suggested that road specifications and planning could be improved to take more consideration of biodiversity conservation issues. Particularly important is that roads into harvesting areas are properly closed after blocks are harvested in order to prevent illegal access and speed up recovery.

One positive example of the incorporation of biodiversity conservation into production forestry is in the Perak Forest Management Unit[140]. Here, as part of the commitment to SFM, the forestry department put in place protection measures above and beyond those required by law. Working together with NGOs, the authorities identified and protected trees that contained the nests of hornbills (Misni, Rasam and Buyadi, 2017), as well as salt-licks used as mineral sources by large mammals,

[134] https://en.wikipedia.org/wiki/Orang_Asli
[135] www.mybis.gov.my/sp/56096
[136] www.gbif.org/species/165627795
[137] www.hcvnetwork.org/
[138] https://news.mongabay.com/2016/11/can-fig-trees-regrow-lost-rainforests
[139] Skid trails, also known as skid roads, are temporary roads or trails used by logging equipment to remove logs from a timber stand. The equipment travels on the skid trails bringing the cut trees from where they were cut down to the log landing (the collection point for the cut wood).
[140] www.sirim-qas.com.my/wp-content/uploads/2019/12/Public-Summary-FMC-of-Perk-Forest-Management-Unit-Recertification-Assessment-3rd-Cycle_v1.0.pdf

important for the prey species of Malayan tigers (Lazarus *et al*., 2021).

TABLE 1.
Area of certified forest management units in Peninsular Malaysia (2021)

Scheme	Forest management unit (FMU)	Area (ha)
MTCS	Negeri Sembilan	155 549
	Pahang	1 504 407
	Perak	988 604
	Selangor	238 747
	Terengganu	540 309
	Johor	285 293
	Total	3 712 909
FSC	Asrama Raya	10 000
	KPKKT	106 697
	Total	116 697

Source: https://info.fsc.org; www.mtcc.com.my

5.5. RESTORATION/REFORESTATION PROJECTS

Overview

This section addresses the mainstreaming of biodiversity conservation in forest restoration and reforestation projects. In particular, it considers the conversion of degraded habitats into plantations for timber and non-timber forest products.

Policy

The Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) includes several policies related to forest restoration. It mentions Malaysia's 100 Million Tree-Planting Campaign[141] and the Central Forest Spine Master Plan, which includes the objective to restore forest connectivity in certain strategic linkages. The Malaysia Policy on Forestry notes that these initiatives are in conjunction with the UN Decade on Ecosystem Restoration 2021–2030[142,143].

In addition, the Malaysia Policy on Forestry (Peninsular Malaysia Thrust 7, Strategy 3) specifically notes the importance of taking wildlife habitat into consideration when carrying out forest development.

[141] https://habitatfoundation.org.my/2021/05/19/invitation-to-the-greening-malaysia-100-million-trees-webinar-series/
[142] https://th.boell.org/en/2021/06/04/ecosystem-restoration-malaysia
[143] www.decadeonrestoration.org/

Laws

At present, the law does not distinguish between planted forests or naturally regenerated forests. The Environmental Quality Act 1974 has a lower threshold[144] for requiring EIAs for projects that involve the "conversion of hill forest land to other land use" (Mahmud, 2021). However, the law is silent on whether clearance of a degraded natural forest for a timber plantation constitutes a change in land use. Most of the requirements for the sustainable management of timber concessions (e.g. reduced impact logging, etc.) do not apply when land is cleared for the establishment of a timber plantation. Similarly, there is no explicit legal protection given to endangered species or ecosystems that may be affected by land clearance for the establishment of a timber plantation (Wyn, 2013).

Practice

In practice, the Forest Plantation Development Programme[145] has involved the establishment of timber plantations on over 62 061 ha in Peninsular Malaysia (**Table 2**). This Programme only involves approximately 9 percent of the forest estate, but is nevertheless a significant driver of natural forest clearance and biodiversity loss. The Forestry Department Peninsular Malaysia took several steps to mitigate the effects on biodiversity during the establishment of timber plantations, including ensuring that they did not affect high conservation value (HCV) areas. These steps have been deemed sufficient in most cases, with the exception of the Kelantan, where excessive conversion of natural forest to plantations resulted in the suspension of the PEFC certificate[146].

Species diversity in the plantations is usually low, with monocultures being the norm. The Forest Plantation Development Programme comprises eight tree species, including four native species, and bamboo. The within-species diversity of the trees planted is also usually low, with clonal planting stock rather than wild-sourced planting material being used. There is, however, an effort to increase the diversity of clones available, for example, with 185 different types of latex/timber clones having been developed for rubber trees (*Hevea brasiliensis*) (Malaysian Rubber Board, sd).

TABLE 2.
The Forest Plantation Development Programme in Peninsular Malaysia (2006–2020)

State	Agreements	Area (ha)
Perak	5	4 100
Kelantan	33	38 211
Selangor	3	3 680
Pahang	8	8 700
Johor	4	7 369
Total	**53**	**62 061**

[144] https://news.mongabay.com/2020/12/pollution-water-cuts-strengthen-calls-for-environmental-law-reform-in-malaysia
[145] www.mtib.gov.my/en/services/forest-plantation/development-of-forest-plantation
[146] https://mtcc.com.my/withdrawal-of-the-certificate-for-forest-management-of-the-kelantan-state-fmu

5.6. INDIGENOUS PEOPLES

Policy

This section considers the extent to which Orang Asli communities are involved in forest management in Peninsular Malaysia. The Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) explicitly recognizes the importance of considering the rights of Indigenous Peoples and local communities (IPLCs) to own, use and manage their areas and resources (Wook, 2015; Radu, 2019; Kamal, 2020; Law, 2021). For the first time, the policy recognizes the potential to involve the Orang Asli in forest management, including social forestry and agroforestry, and explicitly acknowledges the importance of the forest for the Orang Asli for shelter, food, domestic use, fuelwood, and cultural and religious heritage. The policy action plan (Thrust 7, Strategy 2(a)) includes the need to identify areas inside forest reserves that are of importance for the Orang Asli and to resolve any conflict arising from production forestry activities.

Laws

The National Forestry Act contains a number of special provisions regarding the rights of the Orang Asli. In particular, the Act (s40(3); s62(2)(b)) provides for their exemption from the need to obtain a license for or the payment of royalty in respect of: forest produce removed from any alienated land[147] for the construction and repair of temporary huts; the maintenance of fishing stakes and landing places; fuelwood or other domestic purposes; or the construction or maintenance of any work for the community's common benefit. However, the Act does not recognize Orang Asli rights or privileges within permanent reserved forests, and (s113(b)) explicitly extinguishes any previously recognized rights or privileges. Thus, according to the National Forestry Act, the Orang Asli have no traditional rights within permanent reserved forests[148] and are not permitted to enter without a permit[149].

Despite the lack of recognition under the National Forestry Act, the law courts have held that the traditional rights of Orang Asli do persist in certain cases. For example, in 2017, the state of Kelantan and the Temiar Orang Asli of Pos Balar reached a consent agreement[150] regarding the management of the Sungai Betis and Sungai Perias permanent reserved forests.[151,152] These rights consisted of: 1. the Temiar tribe having hunting, fishing and foraging rights in the permanent reserved forest surrounding their villages; 2. their cultivated lands being recognized as aboriginal areas; 3. there being no logging in these areas; 4. twenty-eight key areas

[147] www.ketsa.gov.my/en-my/KetsaCore/Land/Pages/default.aspx

[148] https://foe-malaysia.org/articles/legal-classes-of-forests-and-conservation-areas-in-malaysia/

[149] https://loggingoff.info/wp-content/uploads/2017/02/2016-SAM-JKOASM-Encroachment-on-Orang-Asli-customary-land.pdf

[150] A consent agreement is a legal contract that governs the relationship between parties where one party gives informed consent to participate in an activity.

[151] https://ejatlas.org/conflict/deforestation-on-orang-asli-temiar-territory-in-the-balah-permanent-forest-reserve-gua-musang-malaysia

[152] www.rescu.com.my/2022-02-25%20Malaysia%20Land%20Laws%20RESCU%20FCDO.pdf

being protected, including 23 areas gazetted as water catchment areas.

Furthermore, the Wildlife Conservation Act 2010 (s51)[153] gives an exemption for the Orang Asli to hunt ten species of protected wildlife (including three monkeys, two deer, two porcupines, two birds and one wild boar) for subsistence purposes[154].

Practice

While the Orang Asli community are marginalized politically, socially and economically, the Malaysian government has embarked on a programme[155] to work together with Orang Asli communities and afford better recognition of their rights, in line with the Malaysian Policy on Forestry (Ministry of Energy and Natural Resources, 2021). In terms of biodiversity conservation, the government has engaged Orang Asli communities through the common purpose of controlling poaching[156]. The 2021 federal budget included RM 20 million (USD 5 million) for retired armed forces and police personnel to patrol jungles together with the Orang Asli in a move to safeguard biodiversity under a Biodiversity Protection and Patrolling programme[157]. In addition, the Malaysian Policy on Forestry proposes carrying out social forestry and agroforestry with Orang Asli and local communities.

5.7. COMMUNITY FORESTS

Policy

As noted earlier, the Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) has an explicit policy thrust in relation to increasing the involvement of local communities in forest management (mentioning social forestry, agroforestry and recreation). In addition, the policy mentions the scope for urban forestry, including reforestation and tree planting programmes[158].

Laws

The National Forestry Act (s45-46) allows for permanent reserved forests to be declared as Open Forest, allowing for recreational and other public needs. At present, the Act does not provide any mechanism for the community to be involved in the co-management of such open forests. In the state of Selangor[159], the National Forestry Act 1984 has been amended to allow the local community to have the right to participate in an enquiry prior to the excision of land from permanent reserved forests. As such, Selangor is the only state in the Peninsula with this requirement to hold an enquiry.

---

153 http://extwprlegs1.fao.org/docs/pdf/mal107883.pdf

154 www.investigative.earth/pangolins-malaysia/indigenous-hunting-and-wildlife-conservation

155 https://foe-malaysia.org/articles/orang-asli-development-blueprint-must-recognise-their-customary-land-rights

156 www.thestar.com.my/metro/metro-news/2022/03/30/rope-in-orang-asli-to-flush-out-poachers

157 https://themalaysianreserve.com/2021/07/31/600-military-vets-orang-asli-appointed-as-wildlife-rangers

158 www.mybis.gov.my/pb/4848

159 www.macaranga.org/empower-the-dewan-to-safeguard-forest-reserves

Practice

A total of 74 areas inside permanent reserved forests in Peninsular Malaysia have been designated as recreational areas that provide opportunities for recreation, including picnicking, camping, hiking and swimming. In addition, one forest in Selangor has been informally designated as Kota Damansara Community Forest[160]. Here, the State Forestry Department has been working with the local community in the management of the forest (Vaz and Lim, 2012), including the planning and maintenance of a series of trails for hiking and mountain-biking. These trails have been designed to avoid damaging the habitat of rare plants such as the flower *Begonia aequilateralis.*

5.8. CONCLUSIONS AND LESSONS LEARNED

Mainstreaming biodiversity conservation in forest management in Peninsular Malaysia shows a mixture of results (**Table 3**). Overall, the policies are adequate and show an improving trend, with the Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021) covering all the aspects assessed. The legal framework is improving but there are still significant gaps that have yet to be closed, while some aspects of biodiversity conservation are virtually non-existent in the existing laws (such as protection of biodiversity against the clearance of natural forests for plantations). Practices have significant gaps, with mixed developments. Some areas are improving, largely due to the commitment to certified sustainable forestry management, as well as increased inter-agency cooperation, and no areas of practice are clearly deteriorating.

TABLE 3.
Summary of biodiversity mainstreaming in Peninsular Malaysia

	Forest Management		
Aspect assessed	**Policy**	**Laws**	**Practice**
1. Context for biodiversity conservation	↗ ●	↗ •	⇌ •
2. Institutional arrangements for biodiversity	↗ ●	↗ •	↗ •
3. Biodiversity in timber concessions	↗ ●	↗ ○	⇌ •
4. Biodiversity in restoration projects	↗ ●	→ ○	⇌ ○
5. Indigenous peoples and their rights	↗ ●	⇌ ○	⇌ •
6. Biodiversity in community forests	↗ ●	→ •	⇌ •

Levels		Trends	
Adequate	●	Clearly improving	↗
Significant gaps	•	Not much change	→
Virtually non-existent	○	Clearly deteriorating	↘
		Mixed developments	⇌

[160] http://kotadamansaraforest.org

Source: Authors' own elaboration.

The main lesson learnt for improving the mainstreaming of biodiversity conservation in forest management in Peninsular Malaysia would be to implement the sound framework provided by the 2021 Malaysia Policy on Forestry.

Several specific lessons learned, above and beyond those in existing policies, are highlighted below:

- Carry out a comprehensive economic valuation of biodiversity, as part of a national natural-resource accounting programme that assigns appropriate budgets for the management of biodiversity.
- Amend the forestry legislation to restrict the conversion of natural forests to plantations and end the policy promoting the establishment of monoculture timber plantations and open-cast mines[161] inside permanent reserved forests, i.e. consider expanding the policy of no net-loss of biodiversity (zu Ermgassen *et al*., 2019) from Sabah to Peninsular Malaysia.
- Enhance and elaborate on legislation and regulations related to the rights of Orang Asli communities inside permanent reserved forests, giving provisions for the creation and management of community forests.
- Enhance public consultation in forest management planning, including expanding the right to public hearings prior to excision of permanent reserved forests, as required in Selangor, and allow the public to review management plans, particularly with respect to high conservation value (HCV) identification, management and monitoring (and allocate resources for increasing the number of locally-accredited HCV assessors).
- Carry out a national-level assessment of important plant areas (Hamidah *et al*., 2020) and expand the Central Forest Spine initiative to include a programme of assisted migrations in order to ensure that genetic diversity is maintained throughout the Peninsula.
- Consider amending existing legislation to give protection for endangered species of plants, as well as animals, including protection for the habitats of such species (possibly along the lines of an Endangered Species Act). Such legislation could create a Forest Enforcement Agency with broad enforcement powers related to biodiversity protection in permanent reserved forests, as well as protected areas.
- Empower the CITES management authorities to manage biodiversity within permanent reserved forests or reconsider the agency designations. In particular, the Department of Wildlife and National Parks should be empowered to manage animals within permanent reserved forests and the Department of Agriculture should be empowered to manage non-timber terrestrial plants within permanent reserved forests, or otherwise designate the Forestry Department Peninsular Malaysia as a CITES management authority.
- Put in place a mechanism to review and update best practice guidelines for sustainable forest management to improve practices for biodiversity

[161] https://foe-malaysia.org/articles/call-to-halt-proposed-open-cast-mining-of-manganese-ore-in-gua-musang-kelantan

conservation, including enhancing existing design specifications for roads inside permanent reserved forests.

The management of biodiversity in Peninsular Malaysia is complicated due to both the high levels of species richness, endemism and ecosystems, as well as a federal administrative system. Given these difficulties, it is encouraging that the authorities have developed a comprehensive Malaysia Policy on Forestry (Ministry of Energy and Natural Resources, 2021). The challenge over the coming years will be to translate this policy into laws and practices that safeguard the full panoply of genetic diversity at the level of populations, species and ecosystems for the benefit of all Malaysians, including future generations.

6. Mexico

Clemencia Licona Manzur and Rhodri P. Thomas
CC Env Consulting

6.1. CONTEXT

A highly diverse country

Mexico is one of twelve megadiverse countries that together are home to about three quarters of the Earth's biota. Despite having an area that represents only 1.5 percent of the planet's surface, Mexico is home to 10–12 percent of all species. This diversity is the result of its location, complex geology, topography, and multiple climate zones (CONABIO, 2016). According to a recent estimate, the country is home to between 180 000 and 216 000 species, many of which are endemic, including 21 species of pine (*Pinus* spp.), 146 agaves (*Agave* spp.) and 715 cacti (Cactaceae) (SEMARNAT, 2020a). Mexico occupies fourth place in the world for vascular plant richness and third for angiosperms (Villaseñor and Ortiz, 2014; Mendez-Toribio *et al*., 2018).

Mexico has 137.8 million ha of forested land, corresponding to 70 percent of the country's continental surface. The most extensive forested land is occupied by xerophilous scrub (40.8 percent), followed by forests (24.8 percent), tropical forests (21.8 percent), other forest areas (11.5 percent), mangroves (0.7 percent) and other forest associations (1 percent). Mexico also has a significant area of primary forest (CONAFOR, 2020a) and an important share of the world's mangroves (FAO and UNEP, 2020).

The country is also culturally and linguistically diverse. In 2015, about seven million people spoke one of 68 indigenous languages (INPI, 2017). This cultural diversity contributes to the complexity of natural resource management. In the last decade, the territories of indigenous communities represented 14.3 percent of the country. Most of the humid, mesophilic and humid temperate forests are under the custody of indigenous communities (Sarukhan et al., 2009).

The forestry sector

In 2015, the area of land with timber potential was estimated to be 21.6 million ha. Between 1993 and 2008, around 8 million ha were being harvested annually, producing an average of 7.5 million m^3 per year (Anta Fonseca *et al*., 2008; Merino *et al*., 2008). By 2014, the harvest had fallen to 5.7 million m^3, recovering to 9 million m^3 by 2017, but still short of its potential (CONAFOR, 2020a). From 2013 to 2018, the value of timber and non-timber forest production was USD 2 170 million and contributed to 0.24 percent of Mexico's GDP (SEMARNAT, 2020a). The country officially produces about a third of the timber products it consumes, with the

remaining demand satisfied by illegally extracted products and imports.

Around 230 000 ha of commercial forest plantations were registered in 2019. The most commonly planted species were eucalyptus (*Eucalyptus urophylla, E. grandis and E. camaldulensis*), red cedar (*Cedrela odorata*), pine (*Pinus patula, P. greggii and P. pseudostrobus*), teak (*Tectona grandis*) and melina (*Gmelina arborea*) (CONAFOR, 2020a). Timber production is not highly diversified, with three quarters of the production coming from *Pinus.*

There is also a long tradition of using non-timber forest products (NTFPs). Around one thousand NTFPs are obtained from 5 000–7 000 species (Torres-Rojo, 2004). Commercial forest plantations of NTFPs represented 29 percent of the total commercial plantations established between 2000 and 2018, with the highest production being for fibres, gums, waxes, leaves, bamboo, Christmas trees and fuelwood. The production of NTFPs increased from 62 000 to 99 000 tons between 2007 and 2018 (SEMARNAT, 2020a). However, there is no overview of the effects of NTFP harvesting on ecosystems, due to the scarcity of information on uses, legal and illegal extraction rates, and the collection, production and commercialization processes (CONABIO, 2016).

Currently, almost 48 percent of forest production is certified for good management practices: 1.42 million ha by the Forest Stewardship Council (FSC)[162]; 730 000 ha by the Official Mexican Standards (Norma Oficial Mexicana); and 500 000 ha by the Preventive Technical Audit (Auditoría Técnica Preventiva)[163] instrument. About 2.5 million ha of the certified areas are owned by agrarian nuclei and 150 000 ha by smallholders (SEMARNAT, 2020a).

Challenges for the forestry sector

Aside from having a forestry sector that is currently underperforming, Mexico is losing forest cover and its associated biodiversity. Government policies between 1940 and 1980 supported clearing of primary forests for agricultural production (Challenger and Dirzo, 2009). A study of vegetation cover for 1993–2016 found that primary forest continued to decrease over the period, albeit at a slower rate than previously (Paz Pellat *et al*., 2019). Between 2010 and 2015, the annual net rate of deforestation was 122 500 ha (CONAFOR, 2020b). Rainforest and mesophilic forest, which represent the least common types of primary vegetation in Mexico, have been subject to the greatest degradation (CONAFOR, 2018c). Nevertheless, there is a significant amount of community-owned land in regions such as Chiapas, where forests are being actively conserved and restored (Cortina, 2013).

Forest loss has been associated with illegal land use change, clandestine logging, illegal trade in forest products, forest fires, pests and diseases, and inappropriate forest management practices. Despite the government authorizing land use change at an annual average of only 12 000–13 000 ha, the gross annual deforestation rate is currently almost 350 000 ha (SEMARNAT, 2020a). The amount of land destined for agriculture grew by 12.6 percent to 32.7 million ha between 1993 and 2016 (INEGI,

[162] https://mx.fsc.org/mx-es

[163] www.gob.mx/conafor/acciones-y-programas/autorizacion-para-realizar-auditorias-tecnicas-preventivas-atp

2015). The greatest impact has come from highly profitable large-scale agricultural activities, such as the cultivation of avocado, oil palm and soybean, as well as meat production, although subsistence farming has also contributed. Some agricultural management practices can increase the likelihood of forest fires and the production of greenhouse gas (GHG) emissions (CONABIO, 2016). Other activities that contribute to deforestation are tourist developments, mining, real estate projects and the cultivation of plants for illegal drugs (Global Forest Watch, 2019; Del Castillo, 2020).

The transformation of natural forest into plantations with just one or a few species (Sarukhán *et al*., 2012) also threatens biodiversity. The impact may be exacerbated by the introduction of exotic species, such as *Eucalyptus* spp., *Tectona grandis* and *Gmelina arborea*.

The frequency and intensity of forest fires, droughts, pests and diseases is expected to increase with climate change, having an impact on forests and their biodiversity. At the ecosystem level, the area of mountain mesophilic forest is predicted to decrease 67 percent by 2030 due to climate change (Rehfeldt *et al*., 2012).

Socioeconomic conditions also have an impact on forest management. An estimated 10.9 million people live in forest areas, including many in conditions of poverty and marginalization (SEMARNAT, 2020a). For instance, 16.4 percent of people in rural populations experience extreme poverty compared with 2.5 percent in urban populations (CONEVAL, 2019). As such, forest production takes place in an environment with serious complications for enterprises. Corruption – a growing systemic problem that generates costs, risks and uncertainty – and the violence and insecurity associated with organized crime, have segregated entire territories from the law. Trade policies also create unfavourable conditions for national production, through differences with other countries in terms of regulation, subsidies and prices (Chapela, 2018). Furthermore, the economic effects of COVID-19 are also being felt (CONAFOR, 2020b).

Land tenure and protected natural areas

Currently, there are four types of land ownership in Mexico: private property (or smallholding); agrarian nuclei (or social property); federal land; and wasteland. A distinctive characteristic of the land tenure system in Mexico is that it recognises the social ownership of land, as The Mexican Constitution of 1917 included significant rural and agrarian reforms that set out a new system of social property, embodied in agrarian nuclei, including agrarian communities (historical form of land ownership) and *ejidos* (expropriated land given to communities).

Ejidos and *comunidades agrarias* vary in size both in terms of land area and population. Morett-Sánchez and Cosío-Ruiz (2017) calculated that approximately 5.6 million people live in agrarian nuclei (29 490 *ejidos* and 2 347 *comunidades agrarias*), covering about 102 million ha (Torres-Rojo, 2015). In 2019, 15 500 agrarian nuclei owned 62.6 million ha of forest resources, representing 45 percent of the country's forest cover (SEMARNAT, 2020a). By 2019, 4.4 million ha of production forests were owned as social property in agrarian nuclei[164] and 1.1 million ha as

[164] www.landcommission.gov.scot/our-work/ownership/international-experience/mexico-communal-agrarian-tenure-ejido-system

smallholdings.

In the last decades, changes in rules over management of forest resources have been driven by both government and agrarian nuclei. Agrarian nuclei have been described as "formal institutions that are adapting to a new role in resource production" (Antinori, 2000 in Bray and Merino-Pérez, 2000; Merino-Perez and Segura-Warnholtz, 2005).

Social tenure has also influenced protected areas (PA). In many countries, the creation of protected areas (PAs) frequently implies the eviction of the populations that live there (West, Igoe and Brockington, 2006). In Mexico, however, this is not the case (Bezaury-Creel, Gutierrez-Carbonell and Remolina, 2009). The Biosphere Reserves and the Flora and Fauna Protected Areas, two of the six categories of PAs defined in the General Law of Ecological Equilibrium and Environmental Protection (DOF, 2021a) explicitly consider the possibility that the local population can carry out natural resource management activities.

International commitments related to biodiversity conservation

Mexico has made ambitious pledges to restoring degraded ecosystems. Responding to the CBD commitments, it formulated the National Strategy on Biodiversity in 2000 (updated in 2016)[165], committing to the restoration of 15 percent of degraded ecosystems by 2020 (Aichi Target 15.2)[166], as well as increasing plantations of native species in degraded areas without encouraging the loss of natural habitat (Aichi Target 7.7) (CONABIO, 2016). Mexico also participates in the conservation of ecosystems through the Global Strategy for Plant Conservation 2011–2020[167], developing the Mexican Strategy for Plant Conservation (Sarukhán *et al*., 2012), and committing to the CBD's Aichi Targets (CONABIO, 2016).

Mexico committed to the restoration of 7.5 million ha before the Bonn Challenge (2014)[168], and with 13 other Latin American countries, signed up to the 20x20 Initiative with a target to restore 8.5 million ha by 2020. It also takes part in several coalitions, networks and fora, is a signatory of the UN Non-legally Binding Instrument on All Types of Forests, 2030 Agenda, UNCCD, ITTA, CITES, and The New York Declaration on Forests.

6.2. INSTITUTIONAL FRAMEWORK

Mexico is a federal republic, whose form of government involves three different powers: executive, legislative and judicial. It also has different levels of government: federal, regional and local.

Institutions for the protection of forests were first established in 1917, when the Directorate for Forestry, Hunting and Fishing was created in the Ministry of Agriculture. Natural resources, water and forests were declared as a matter of national security in 2000, and as a result, the National Forestry Commission (CONAFOR) was established in 2001 to strengthen the presence of the forestry sector in national

[165] www.cbd.int/reports/search/?country=mx
[166] www.cbd.int/countries/targets/?country=mx
[167] www.cbd.int/gspc
[168] www.iucn.org/theme/forests/our-work/forest-landscape-restoration/bonn-challenge

policies (CONAFOR, 2019). It is a special branch of the Ministry of Environment, which also contains several directorates dealing with forestry and biodiversity.

Apart from the National Forestry Commission, there are various institutions that participate in forestry and biodiversity issues: the most prominent being the National Institute for Forestry, Agricultural and Livestock Research (INIFAP)[169]; the National Institute for Ecology and Climate Change (INECC)[170]; and the Federal Attorney's Office for Environmental Protection[171]. In addition, the National Forestry Council[172] is an advisory body made up of representatives from different government and non-government institutions. The National Commission for the Knowledge and Use of Biodiversity (CONABIO) was established in 2000 to promote biodiversity mainstreaming in different sectors, including forestry (Flores *et al*., 2018).

There are also institutions at the state and municipal levels that are involved in the implementation of forestry and environmental programmes. In addition, a range of civil society organizations and academic institutions are involved in actions and the development of technologies that can contribute to sustainable management of forests and the mainstreaming of biodiversity. There are at least 27 civil society organizations, 25 academic institutions and three broad commerce chambers concerned with forestry governance (Avila *et al*., 2016) and around 300 organizations that participate in the restoration of ecosystems (Méndez-Toribio *et al*., 2018).

6.3. LEGAL AND REGULATORY FRAMEWORK

The Mexican Constitution includes provisions for the right to a healthy environment, access to natural resources, land tenure rights, and the rights of Indigenous Peoples and local communities (IPLCs). There are also several laws that contain provisions related to forestry or biodiversity at the national level, which can be grouped into environmental, rural sector and social development laws.

The General Law of Ecological Equilibrium and Environmental Protection[173] includes provisions related to nature reserves, restoration areas, and wild flora and fauna (DOF, 2021a), while the most important law related to forestry is the General Law of Sustainable Forest Development (DOF, 2021b), but provisions relating to forestry are contained in at least another 13 laws, which can be consulted through the Ministry of Environment's online repository (SEMARNAT, 2021a). In addition, each state has its own set of arrangements, ranging from a state constitution to codes and laws. For example, the State of Veracruz has its own constitution and laws on environmental protection, SFM, regional and urban development and provisions at municipal levels, all of which are pertinent to forest management (CONABIO, 2011).

The latest reform of the forestry legislation, on 26 April 2021, may be a significant step towards biodiversity conservation in forestry, as it decrees that forest land use change can only be granted in exceptional circumstances, with the prior consent

[169] www.gob.mx/inifap/en
[170] www.gob.mx/inecc/en
[171] www.profepa.gob.mx/innovaportal/v/1153/1/mx/about_us_-_mission_vision_and_strategic_targets.htm
[172] www.gob.mx/conafor/documentos/consejo-nacional-forestal
[173] www.mexlaws.com/SEMARNAT/LGEEPA.htm

of the State Forestry Council and supported by technical studies showing that the biodiversity of ecosystems will be maintained, along with mitigation of any changes in soil erosion, carbon storage, and water quality and infiltration. The law also forbids land use change for at least 20 years in forests degraded by fire, slash and burn, or logging (DOF, 2021c).

The right to protect biodiversity originated in hunting regulations contained in the Civil Code of 1870. This evolved into the General Wildlife Law, the objective of which is to regulate the conservation and sustainable use of wildlife and habitats. This law has its antecedents in various international efforts, including the Convention for the Protection of Flora and Fauna and the Scenic Beauties of America, the Convention Concerning the Protection of the World Cultural and Natural Heritage, Ramsar and CITES, but mainly in the CBD.

A paradigm shift in legislation has seen the approach change from protecting individual species and habitats to protecting whole ecosystems (Olivo Escudero, 2016). Despite these changes, the General Wildlife Law still does not address biodiversity in a comprehensive manner. For example, it does not include provisions related to the regulation of genetic resources. As a response, the General Law of Biodiversity was presented to the Senate for approval in 2017, but various stakeholders feared it would not provide sufficient protection for biodiversity, nor the rights of indigenous communities. Hence, the process was halted and the law is currently under review.

The next level of legislation is the regulations and norms. The Normas Oficiales Mexicanas (Official Mexican Standards) are technical standards that set out binding specifications, standards, values and characteristics (De Icaza, 2021). Some of these norms are applicable to forestry and protected species. The forestry sector also has a new regulatory instrument, released at the end of 2020 (DOF, 2020). The Technical Mexican Norms are voluntary instruments to strengthen quality specifications of processes, products and services. Norm NMX-AA-143-SCFI-2015 establishes specifications and minimum requirements to obtain certification for sustainable forest management (DOF, 2015).

A search for authorizations and permits related to forestry and soils revealed at least 50 different instruments (SEMARNAT, 2021b). Of course, they are not all applicable to every individual case, but this illustrates the complexity of meeting the legal requirements. Hence, the smaller the enterprise, the more difficult and costly it is to comply. In tropical zones, the costs associated with permits and requirements for forestry operations are such that it often results in illegal operations or abandonment and conversion to agriculture (Chapela, 2018).

A large amount of work has gone into establishing laws for the protection, conservation and restoration of ecosystems, but they are not always clear in terms of the distribution of powers and the requirements for the implementation of specific mechanisms, such as the fair and equitable distribution of the benefits derived from the use of genetic resources. The focus of laws also varies according to the sector and often contradict one another.

6.4. POLICY FRAMEWORK

Policies are designed at the national level, but their implementation relies on the different levels of government. The general concepts and guidelines pursued by the administration are provided within the National Development Plan (Plan Nacional de Desarollo), currently for 2019–2024 (DOF, 2019a), from which several other plans, programmes and strategies derive. The sectoral nature of strategies may result in different objectives and concepts, which sometimes contradict and hinder the application of policies in sectors, such as forestry, by intersecting with other sectoral policies (Avila *et al*., 2016).

Related sectoral plans and programmes include: Environment and Natural Resources Plan 2020–2014; Strategic Forestry Programme for Mexico 2025; National Forestry Programme 2020–2024; National Strategy for Sustainable Forest Management to Increase Production and Productivity; National Strategy for REDD+ 2017–2030; National Strategy on Mexican Biodiversity and its action plan 2016–2030; Mexican Strategy for Vegetation Conservation 2012–2030; Regional biodiversity strategies; National Strategy on Invasive Species in Mexico: Prevention, Control and Eradication (2010); Mexican Strategy for Plant Conservation (2012–2030); National Strategy on Climate Change; Strategy on Climate Change from the perspective of Protected Natural Areas 2015–2020; National Strategy for Sustainable Land Management (2010).

Since 2002, the government has promoted the development of state biodiversity strategies to improve local human and institutional capacities in planning and managing biodiversity activities. Twenty-two states in Mexico are currently involved in this initiative, nine are already implementing their strategies and two have created their own state commissions for biodiversity.

Biodiversity has been considered in forest strategies since at least 2001, when the Strategic Forestry Programme (PEF) for Mexico 2025 was formulated, but rather as a concept than as an operational feature of forest management (CONABIO, 2018). A more operational move towards mainstreaming biodiversity into forestry management is being promoted through the Strategy for Biodiversity Mainstreaming in the Forestry Sector 2016–2022[174]. This seeks to maintain and increase the efforts to incorporate biodiversity criteria in productive activities, restoration, protection and conservation. It aims to develop the Mexican forestry sector as a generator of wealth for the country, improved provider of environmental services, and a permanent guardian of the country's biological richness. It comprises nine strategic areas by:

1. promoting sustainable forest production, incorporating criteria for the conservation and use of biodiversity;
2. strengthening integral restoration programmes with biodiversity criteria;
3. encouraging biodiversity conservation in forestry ecosystems through payment for ecosystem services (PES);
4. protecting the integrity of forest ecosystems and biodiversity;
5. preserving and improving forest genetic resources;
6. encouraging and strengthening education, communication and culture around biodiversity topics;

[174] www.gob.mx/conafor/documentos/enbiofor

7. harmonizing the legal framework for biodiversity mainstreaming into plans and programmes of the forestry sector;
8. promoting inter-institutional and inter-sectoral coordination to enhance the integration of biodiversity in the forestry sector; and
9. strengthening biodiversity monitoring and evaluation systems.

In addition, the Mexican government and UNDP in Mexico are working to integrate criteria and indicators for the conservation of biodiversity in production forests (Jardel Peláez, 2015).

6.5. ECONOMIC INCENTIVES

The Mexican government manages a series of economic support schemes for a variety of activities in forest regions:

- Payment for Environmental Services Scheme which has benefited 13 200 properties (2003–2019) that voluntarily committed to conserving and sustainably managing their forest ecosystems (CONAFOR, 2020a).
- Sustainable forest management subsidies for implementing actions that contribute to the protection, conservation, restoration and incorporation of land into community forest management (CONAFOR, 2020d). Since 2017, this has included Support for Productive Forestry Projects for Women for the execution of projects led and operated exclusively by women (CONAFOR, 2020e).
- Biodiversity Heritage Fund which is a long-term PES scheme for areas with biodiversity of global importance not covered by an existing protection scheme. It provides financial support to the owners of forest lands, with the aim of conserving biological diversity. To date it has been applied in three areas, covering a total of 39 000 ha (CONAFOR, 2017, 2020a).
- Sembrando Vida, under the National Development Plan under the auspices of the Welfare Ministry, although not a direct forest programme, is designed to serve the rural population in the regions with the highest biodiversity, who live in marginalized communities with incomes below the rural welfare line. The programme was designed to encourage those with at least 2.5 ha to plant agroforestry systems (DOF, 2019b), and would have received USD 1.6 billion in 2021 (Bienestar, 2021).

The effort to promote SFM through government management programmes has been useful mainly for small landholdings (Chapela, 2018). The budget to support SFM is modest and has decreased over the last few years, from USD 260 million in 2016 to USD 46 million in 2021. This amounts to a cut of 65 percent compared with the average annual budget for 2014–2020 (CCMSS, 2020).

The work of individuals and organizations is recognized by the National Prize for Forestry Achievements, which aims to acknowledge and encourage individuals in the private or civil society sector who have taken actions to conserve, protect and restore the sustainable use of forestry resources (CONAFOR, 2020f). Reforestamos Mexico and their partners also award Los Bóscares (Forest Oscars) to private enterprises that take care of forests (Reforestamos, 2020a).

BOX 1

Species protection legislation and its application

The General Law of Sustainable Forest Development requires government authorization to exploit timber resources on forested land. It also requires the presentation of an environmental impact assessment (EIA) in the case of exploiting more than 20 ha in tropical forests, if the species regenerate poorly or are protected, and when located in a protected area (PA). The EIA requires the conservation of biodiversity to be considered (INECC, 2021). However, researchers have found these impact studies to be generic and that they do not facilitate the implementation of specific protection or conservation measures (ECOSUR, 2021). The law also forbids replacing natural forests with commercial plantations. Nevertheless, it does allow for other types of land to be converted (e.g. natural grasslands), whose diversity would therefore not be conserved.

Economic support offered by the National Forestry Commission (CONAFOR) requires biodiversity conservation to be reflected in the management plan, although it does not include mandatory measures to conserve biodiversity. There are, therefore, some situations in which the conservation of biodiversity is not required, e.g. it is not mandatory to carry out an EIA for the extraction of non-timber forest products (INECC, 2021).

There is a tendency to focus on the protection of large mammals, certain birds or flora. Given the impracticality of monitoring every single species, measures are established by functional groups (INECC, 2021). It is a challenge to ensure that species, habitats and ecosystem services are adequately protected (CONAFOR, 2021a), especially in production forests (ECOSUR, 2021). Even with legislation in place, illegal logging accounted for up to 70 percent of the wood harvest between 2013 and 2018 (INIFAP, 2021). Mexico does not have an effective system for monitoring and enforcement. For example, the Federal Attorney's Office for Environmental Protection (PROFEPA) could only carry out 3 400 forest inspections in 2017 (Chapela, 2018).

Source: Authors' own elaboration.

Notes:

Chapela, G. 2018. Avances y retrocesos en la integración productiva de las comunidades forestales de México. In: Las empresas sociales forestales en México. Claroscuros y aprendizajes. México: **CCMSS.** http://www.ccmss.org.mx/wp-content/uploads/2018/10/Empresas_Sociales_Forestales_CCMSS_20102018.pdf

CONAFOR. 2021a. Personal Communication, Questionnaire on Mainstreaming biodiversity in the forest sector, April 2021.

ECOSUR. 2021. Colegio de la Frontera Sur, Campus San Cristobal, Chiapas, Mexico. Personal Communication, Questionnaire on Mainstreaming biodiversity in the Forest Sector, April 2021.

INECC. 2021. Personal Communication (Questionnaire on Mainstreaming biodiversity in the forest sector), May 2021

INIFAP. 2021. Personal Communication, Questionnaire on mainstreaming biodiversity on the forest sector, April 2021.

6.6. MONITORING

The National Forest Monitoring System (SNMF), through its Satellite Forest Monitoring System (SAMOF)[175], has improved the resolution of land cover maps to 1:75 000 scale (minimum unit 1 ha) and identifies up to 34 classes of land cover (CONAFOR, 2020g). To date, land cover maps for the base year 2016 have been produced for five states while land use change maps are in production (CONAFOR, 2021b).

The national monitoring system may detect changes over large areas, but more work is needed to monitor the composition of biota within forests. For this reason, BIOCOMUNI[176] was developed by the National Forestry Commission, in collaboration with Fondo Mexicano para la Conservación de la Naturaleza, A.C. (FMCN)[177], USAID and the United States Forest Service. The aim of BIOCOMUNI is to strengthen community participation in the sustainable use and monitoring of natural resources (BIOCOMUNI, n.d.; FMCN *et al*., 2018).

6.7. INFORMATION GENERATION AND DISSEMINATION

Information on Mexico's biodiversity is compiled and integrated in the National Biodiversity Information System (SNIB) (CONABIO, onlineA), managed by the National Commission for the Understanding and Use of Biodiversity (CONABIO), which also coordinates studies throughout the country. One fundamental study is Capital Natural de México (Natural Capital of Mexico) (CONABIO, onlineB), which involves the participation of hundreds of experts.

Forest communities and enterprises are supported by the National Forestry Commission (CONAFOR), National Institute for Forestry, Agriculture and Livestock Research (INIFAP) and academic institutions through research, technical briefs, periodic publications and field instruction. Examples include: Innovación Forest@l (CONAFOR online), Innovaciones Para El Campo (INIFAP online) and the digital library of the Mesoamerican Center for the Exchange of Forest Knowledge and Experiences (CMICEF)[178]. In addition, the National Forestry Commission and some professional societies are increasingly using social media to distribute information on ecosystem management. Other institutions, such as Colegio de la Frontera Sur[179], Instituto de Ecología[180], and University of Chapingo,[181] have contributed to hundreds of studies, projects and training. The Mexican Civil Council for Sustainable Forestry (CCMSS) supports communities, *ejidos* and smallholders to increase their management capacities, conserve their natural resources and move towards sustainable schemes for the use of their resources (CCMSS, 2020). However, even with all these efforts, there is still a shortfall in access to high quality and timely information, and good technical assistance, while a disconnection remains between the forestry sector and research and technical development (SEMARNAT, 2020a).

[175] https://snmf.cnf.gob.mx/sistema-nacional-de-monitoreo-forestal-2/
[176] www.matrushka.com.mx/project/biocomuni
[177] https://fmcn.org/en
[178] https://cmicef.org/biblioteca/
[179] www.ecosur.mx/el-manejo-forestal-para-los-bosques-del-futuro/
[180] www.ecologia.unam.mx/web/
[181] https://revistas.chapingo.mx/forestales/?section=about&subsec=editorial_bodies

6.8. EXPERIENCES OF BIODIVERSITY MANAGEMENT IN FORESTS

In the past, forest concessions were awarded to third parties who, in general, did not have a long-term vision for production, or conservation and socioeconomic benefits to communities. This situation promoted strong resistance to concessions, especially in Oaxaca and Durango (Hernandez, 2020). Since the enactment of the Forestry Law (1986), institutional reforms and mobilization of communities, a framework for SFM has begun taking shape. However, challenges remain and the quality of SFM varies greatly among the different states (Merino Pérez and Martínez Romero, 2014).

The diversity of ecological, sociocultural and economic contexts of forest areas has resulted in a mosaic of management strategies. The level of SFM varies greatly between the different states, while traditional timber management principles, such as regulation of harvest, sustained yield, and long-term timber productivity, may no longer be achievable or applicable. Many forest owners have no timber production objective at all, with higher priority given to conservation, harvesting of NTFPs, protection of religious and ceremonial sites, and provision of forest services, such as water production, recreation and carbon sequestration (Bray and Merino-Pérez, 2002). About 8 percent of total forest cover is designated as PAs, with very low timber management activities and an emphasis on NTFPs and the provision of forest ecosystem services (Torres-Rojo *et al*., 2016). In some areas, activities such as fishing or hunting and harvesting of NTFPs are carried out under multi-use management (Toledo Aceves and Porter Bolland, 2019). Examples are found in communities in the Mayan rainforest – where precious products such as mahogany timber and gum (chicle) are extracted – and the forest communities in Oaxaca – where significant volumes of wood are obtained and sold, along with harvesting of fungi and orchids, in addition to ecotourism. All these activities represent local sources of employment and income.

Only a third of agrarian nuclei use their forest resources legally and with appropriate tools and machinery (Chapela, 2018). Among those who manage their forests, 14 percent transform the wood, 28 percent deliver it to a sawmill and 58 percent sell unprocessed timber. There are wide regional differences, with Oaxaca standing out for the high proportion of timber processed in-house, while in Chihuahua a high proportion of agrarian nuclei manage their resources, but do not process it themselves.

Forest and forest flora and fauna conservation efforts

Current forest management systems have evolved from traditional silviculture to meet the challenges of the diverse socioeconomic contexts and institutional frameworks. Below are some examples, some of which have included conservation of biodiversity intuitively, while others have introduced it as a response to new government requirements or the requirements of donors.

Selva Lacandona

Mexico's last significant area of tropical rainforest, the Selva Lacandona, located in southeastern Chiapas, is a unique and extraordinarily rich wildlife habitat. In

BOX 2

Indigenous rights and cultural values in forest management

Indigenous rights are increasingly being recognized in policy development. Government PES programmes favour indigenous territories. As such, indigenous communities are formal participants in the National Forestry Council. The recently proposed General Biodiversity Law was halted partly because it did not incorporate practices that guaranteed the protection of genetic resources and traditional knowledge, or the rights of IPLCs (INIFAP, 2021). In principle, there should not be any mining, petroleum exploration or forestry investment in indigenous territories without local consent. The most recent reform to the General Law of Sustainable Forest Development (April 2021) states that "a change of forest to other land use can only be authorized in exceptional cases and in indigenous territories requires consultation" (DOF, 2021b). However, this is not always the case (FAO and FILAC, 2021).

Cultural values within forest areas are considered of high conservation value by the Mexican government (CONAFOR, 2021a), yet very few communities fully incorporate their cultural values into forest management, as current legislation leaves little scope for their inclusion. As a result, forest technicians often lack knowledge of indigenous values or do not consider them relevant (INIFAP, 2021).

There may be a contradiction between conserving species for the cultural values of communities and conserving them for their value as providers of other ecosystem services. For example, some typical rare, mature forest tree species may be overlooked due to their unappreciated or non-existent cultural value (ECOSUR, 2021).

Source: Authors' own elaboration.

Notes:

CONAFOR. 2021a. Personal Communication, Questionnaire on Mainstreaming biodiversity in the forest sector, April 2021.

DOF. 2021b. Decreto por el que se reforman diversas disposiciones de la Ley General de Desarrollo Forestal Sustentable. Mexico: DOF. www.dof.gob.mx/nota_detalle.php?codigo=5616767&fecha=26/04/2021 (Accessed on 10/05/2021).

ECOSUR. 2021. Colegio de la Frontera Sur, Campus San Cristobal, Chiapas, Mexico. Personal Communication, Questionnaire on Mainstreaming biodiversity in the Forest Sector, April 2021.

FAO & FILAC. 2021. Forest Governance by Indigenous and Tribal People. An Opportunity for Climate Action in Latin America and the Caribbean. Santiago.

http://www.fao.org/3/cb2953en/cb2953en.pdf

INIFAP. 2021. Personal Communication, Questionnaire on mainstreaming biodiversity on the forest sector, April 2021.

modern times, the area has been inhabited by the Lacandones, some of whom still practice a highly efficient, ecologically sound system of tropical agroforestry related to ancient Mayan agricultural techniques. Traditional Lacandón agroforestry is a

multiple land use system, involving the utilization of four different zones: milpa (ancient crop rotation system); acahual (fallowed milpa); untouched forest; and aquatic-terrestrial ecotones (swamps, lakes, riverbanks, streams). However, the few remaining Lacandones are locked in a struggle to protect their ancestral home (AP News, 2019). Another example of Mayan communities managing their forests and promoting biodiversity can be found in Levy-Tacher *et al*. (2019).

Central-Western Biocultural Corridor

This is a regional initiative with cross-sectoral coordination that aims to connect PAs and priority ecosystems through conservation, sustainable management and restoration with the participation of communities. Covering an area of 15 million ha, it comprises 17 subzones in the states of Aguascalientes, Guanajuato, San Luis Potosí, Nayarit, Jalisco, Michoacán, Colima and Zacatecas. In 2019, the government conducted research to identify and prioritize sites for conservation, restoration and promotion of sustainable development. Additionally, five interstate agreements were achieved for the conservation of flagship species, such as the golden eagle, jaguar, monarch butterfly, as well as for the restoration of border areas. A technical justification study for a proposed PA in Sierra Cacoma has been carried out, while conservation and restoration has begun in five pilot sites in the Sierra de Manantlán–Nevado de Colima corridor, financed by the Forest Ecosystem Restoration Initiative (FERI)[182] and supported by the Korea Forest Service (Reforestamos, 2019).

Units for the conservation, management and sustainable use of wildlife (UMA)

These are community or privately owned wildlands dedicated to the conservation and management of specific flora and fauna; in forests UMAs cover 15–18 million ha. They are legally registered in accordance with an approved management plan, with continuous monitoring of habitat and wildlife populations. This model creates economic incentives for biodiversity conservation by allowing direct benefits from the exploitation of wildlife or flora (e.g. through hunting, harvesting or tourism). The management plan must guarantee the conservation of specific ecosystems and the viability and survival of wildlife populations, particularly those that are actively harvested (Torres-Rojo, Moreno-Sánchez and Mendoza-Briseño, 2016). This approach has become popular in the temperate and dry areas of northern Mexico, but is less successful in the tropical southern region – due to different ecological and population characteristics of wildlife in the wet compared to the dry tropics, the rate of wildlife consumption by forest inhabitants, and the high poverty rates in this region. Some authors have also argued that this model produces more economic than conservation benefits and needs to be improved (Gallina and Escobedo Morales, 2009; Masés García, Briones-Salas and Sosa-Escalante, 2016). An evaluation of orchid conservation and extraction in a temperate forest was carried out by Ramírez Palomeque *et al*. (2019), who concluded that due to the cumbersome process to obtain permissions, communities may resort to illegal extraction.

[182] www.cbd.int/restoration/feri/

Management of non-timber forests

Most tropical and temperate forests undergo some extraction of NTFPs, while also supporting varying levels of tourism, cattle ranching and agroforestry. In principle, harvesting activities are regulated and only permitted after the approval of a management plan. However, authorities do not have the resources to monitor compliance and there are no specific biodiversity conservation requirements. Ecotourism is gaining in popularity, particularly in areas close to large coastal resorts. In these areas, forest management not only aims to conserve habitats but also to protect the cultural heritage from threats such as hurricanes, fires, and other environmental hazards, as is the case in the Yucatan Peninsula (Torres-Rojo, Moreno-Sánchez and Mendoza-Briseño, 2016).

Management in timber plantations

Around 1 million m^3 of timber are produced in plantations of various sizes, although large scale plantations, such as those found in the rest of North America, are absent. The plantations are normally established on agricultural land or where forest cover has been lost, and can be owned by private companies or communities. The main barriers to private companies are access to land, lack of incentives for private investment and opposition due to environmental concerns. Some commercial forestry plantations have been set up (CONAFOR, 2013), but few consider biodiversity. Most forest plantations are monoculture and little research is available, including for timber agroforestry systems (CONAFOR, 2014).

An exception is Ejido Verde[183], a partnership between the pine resin industry and rural communities, that assists *ejidos*, indigenous communities and smallholders to establish plantations on degraded or abandoned land in Michoacan (Ejido Verde, 2020). Ejido Verde's strategy aims to maximize resin yield, while considering mixed land use, biodiversity restoration and soil conservation. In collaboration with each community, Ejido Verde designs plantations specific to an area's resources and native vegetation.

Community forest enterprises

Mexico is considered a pioneer in community forest management (CFM), in part due to its land tenure system (Gómez Durán, 2019). Management of community forests is mainly oriented towards commercial production of timber products, with some investment in transformation processes and commercialization of finished products. As such, CFM contributes to the conservation of biodiversity, including agrobiodiversity, and local governance (Hernandez, 2020; Merino Pérez and Martínez Romero, 2014).

Around 2 900 agrarian nuclei use part of their forest resources, but under half have managed to scale up and create community forest enterprises. Community forest management has also advanced regarding sustainable forest management (SFM) certification, even if there is still scope for improvement, as it is often seen as an additional burden. By 2015, more than 80 communities were certified, covering

[183] https://ejidoverde.com/

an area of more than 850 000 ha, i.e. more than 10 percent of total timber forest (Fernández Vázquez, 2015). In 2020, the Ejido Nuevo Becal, Campeche was awarded the first FSC Ecosystem Services Certification in North America (CONAFOR, 2020b).

Some examples of community forest enterprises are presented below, although there are many more (Fregoso Rojas, 2019; Montoya Gandarillas, 2019; CONAFOR, 2020e; FAO and FILAC, 2021).

Ejido Ingenio El Rosario

Located on the eastern slope of the Cofre de Perote mountain at an altitude between 2 300 and 2 900 m a.s.l. in Xico, Veracruz, this enterprise covers about 560 ha. The inhabitants have an open forest culture compared to other *ejidos* in the region, based mainly on the production of timber — the area is subject to frequent clandestine logging and there was extensive exploitation during 1940–1970. Tree species include *Pinus patula* (80 percent), *P. montezumae*, *P. ayacahuite* var. *oaxacana*, *Quercus crassifolia*, *Abies hickelii* and *A. religiosa*. The community's main interest is the maintenance of timber harvests, and the ejido has exceeded the legal requirements for the protection of several tree species, while the extraction of other species has been restricted. The factors that have contributed to the sustainable management of its forests are an internal leadership with vision, the existing forestry tradition and technical support provided. Pressures that can influence progress have been identified as the lack of permanent technical advisers, costs of labour, excessive dependence on the timber resource and the lack of access to low-impact technologies (CONABIO, 2011).

Indigenous community of Nuevo San Juan Parangaricutiro, Michoacan

This enterprise is formed by a Purépecha community committed to the management of its temperate forest resources. It occupies 19 000 ha, of which 10 000 ha are used for timber production, about 3 500 ha are under traditional agriculture and 500 ha are used for intensive orchard production, mainly avocado and peach (Velázquez *et al*., 2015). They have been operating more formally since the 1970s. After a few years, they requested the help of the National Autonomous University (UNAM) to produce an integrated community-based resource management plan — with the objectives of identifying NTFPs and accessing markets for other forest services; improving forest data handling; and strengthening technical capacity and leadership within the community. This resulted in biodiversity surveys, training, a comprehensive plan and monitoring. Among other activities, a breeding programme for the white-tailed deer (*Odocoileous virginianus*), a culturally important species, was launched in 1995 in response to the decline in population. Hunters became stewards of the deer population, and the nursery became an attraction in their ecotourism programme. Ecotourism has created several full- and part-time jobs, with visits to the Parícutin Volcano and hiking attracting thousands of tourists who can lodge in cabins and learn about forest conservation. The enterprise currently produces around 65 000 m^3 of timber and 1 100 tons of resin annually, providing 850

permanent jobs with an annual revenue of USD 11.5 million. The enterprise is seen as an example of the old agrarian society merging with a modern productive structure, while traditional rules are used to govern community life and economic activity, and cultural and institutional identities are maintained.

Reforestation and restoration

In 2014, CONAFOR set a target of reforesting 1 million ha by the end of 2018 (in addition to the Bonn Challenge and Initiative 20x20), which they achieved with investment of approximately USD 591 million. Plant survival increased from 33 percent in 2014 to 64 percent in 2018. The programme established procedures for the collection and reproduction of tree species, and CONAFOR provided technical assistance and periodic financial support to enable landowners and communities to implement restoration projects (Initiative 20x20, 2021a).

Part of this work took place in the extremely degraded, dry saline soil in the basin of Mexico's drained Lake Texcoco where, together with Land Life Company, CONAFOR used biodegradable cocoons containing nutrients and water to protect saplings. Three years into the project, 80 percent of the *Cupressus*, *Casuarina* and *Tamarix* trees had survived, some reaching over eight metres tall (Initiative 20x20, 2021b). In Ejido Carmen Serdán, reforestation using mesquite (*Prosopis* spp.) trees was undertaken to both revitalize the environment and provide economic opportunities including charcoal and furniture production for local farming communities (Initiative 20x20, 2021c).

Although reforestation has been carried out mainly with pine species, these plantations are also seen as an opportunity to restore and reintroduce a wide range of other native species through successional reforestation (D'Antonio and Meyerson, 2002). Areas of mountain mesophilic forest have been restored in Veracruz (Sánchez-Velásquez and García-Moya, 1993; Ramírez-Bamonde, Sánchez-Velásquez and Andrade-Torres, 2005) and the reintroduction of *Brosimum alicastrum*, a keystone forest tree and underutilized crop, has been successful in some tropical rainforests (CONABIO, 2011; Sánchez-Velásquez *et al*., 2004).

A study by CIFOR found that around 400 restoration projects have been carried out in the last 15 years in temperate and tropical forests, wetlands, mangroves and riparian ecosystems. They evaluated 75 of these projects, i.e. comprising a total area of 1.5 million ha. Although, the total area restored to date falls short of the proposed goal of 8.5 million ha by 2020, it has been a catalyst for restoration (Méndez-Toribio *et al*., 2018; Martinez Garza *et al*., 2021).

Mejores Alianzas, Mejores Bosques, a programme of Reforestamos México, links the private sector, governments, communities, academia and organizations to promote projects that directly impact the sustainable development of forests. Its aims are raising awareness of the value of biodiversity, reducing habitat loss, controlling exotic invasive species, managing and connecting zones, maintaining genetic diversity, restoring ecosystem services and integrating traditional knowledge with modern techniques (Reforestamos Mexico, 2020b).

6.9. CONCLUSIONS AND LESSONS LEARNED

Mexico has worked for decades to strengthen the institutional, legal and public policy framework to protect natural resources. Concepts have evolved along the way and considerations of pollution, climate change, ecosystem and biodiversity management have been progressively incorporated into this framework. The number of institutions that deal with environmental issues has grown significantly. At the same time, economic development and the environmental agenda often seem to have taken different paths. This can be seen in the encroachment of agricultural activities into forests, or the difficulty in obtaining permissions for forestry operations due to conservation requirements. For the forest sector this has created duplication, blurred institutional roles and responsibilities, and conflicts at the operational level.

Mexico has a broad legal framework, developed over more than a century and which, in principle, should support sustainable forest management (SFM) and the protection of biodiversity. However, there are still laws and regulations that conflict with one another, both between sectors and across national and regional levels. Efforts by the National Forestry Commission to harmonize national and regional forestry laws will hopefully provide an opportunity for mainstreaming biodiversity. The latest national forestry law reform provides stronger elements to protect biodiversity. Paradoxically, in some aspects there is over-regulation, which creates uncertainty and high costs. Obtaining permits is often difficult and time consuming, which may hinder quick responses to, for example, the effects of natural disasters. This often leads to illegal operations posing a challenge to biodiversity conservation. Apart from streamlining permissions, the personnel to process them and to carry out inspections is also required. Decentralization and strengthening the capacities of regional and local government may help. A proposal to tackle the over-regulation that affects the forestry sector is available (CCMSS, 2016).

The environmental, forestry and rural governance frameworks have become overly burdensome, and a degree of harmonization and reintegration is needed. A clear common goal is required. While this should be provided by the National Development Plan, unfortunately this often does not translate into legislation, regulation or operation (CONAFOR, 2020b). The introduction of the Integration Strategy for the Conservation and Sustainable Use of Biodiversity (2016–2022), the use of the National Forestry Council and Regional Forest Councils to agree on common agendas and work with regional biodiversity commissions should be positive steps towards coherent biodiversity policies at the field level.

Certification currently is not perceived as a means to obtain premium prices, but an extra burden among the plethora of requirements, perhaps because of an underdeveloped market, but it has been useful in promoting SFM. The government uses a variety of economic support mechanisms for SFM, which can help but lack large scale impact. A budget to support the ambitious forestry targets is needed to reduce deforestation by 2030 in order to fulfil these commitments, keep forest ecosystems healthy and improve the living standards of forest communities. Another issue is the continuity of support for specific programmes across administrations. For example, this is a concern for the Sembrando Vida programme, which for 2021

appears to have a budget 35 times larger than the SFM support programme, but it is only guaranteed for four years.

The links between science, technology and the field are as important as economic support in contributing to self-sufficiency in forestry operations. In the last decades, the pool of experts in basic research, technology development and monitoring has increased, but it is still insufficient to support a diverse forestry sector. More investment is needed for information generation and dissemination, and local capacity building, especially if biodiversity concerns are to be fully integrated into forestry management. Changing the perception that preserving biodiversity and ecosystem services are just an extra level of bureaucracy, or a romantic notion, requires education at different levels and more accessible ecosystem-specific information. In addition, building capacity in forest operations reduces costs and may reduce economic migration by encouraging young people to stay in their communities.

Further coordination is needed between research and the field. Researchers are investigating how to characterize, conserve, manage and restore forests and their biological diversity under a changing climate, but the information often languishes in research papers. This could be the result of the current policy that gives economic incentives to researchers for the number of papers they publish in peer reviewed journals. Perhaps assigning incentives to papers with more field- or public-oriented impacts would help, as well as recognizing researchers for their societal contributions, such as advising government or communities. If there is a positive outcome from COVID-19, it is that it has normalized the use of virtual fora to exchange information. Seminars open to the general public are more common, and social media platforms could play an increasingly important role in information exchange between forest communities, academia, civil society and government. They may also be an opportunity to better incorporate valuable indigenous knowledge into forestry management. Currently, a dialogue is needed to identify and promote useful practices and debunk those that are not.

A different, but fundamental issue, is the proliferation of illegal operators, which distorts the market, reduces profits of legally operating companies and hinders efforts to maintain biodiversity. Illegal logging and extraction of wild flora and fauna are of particular concern. Actions that could be taken include regulating lumber yards, increasing surveillance through coordination of efforts from different ministries (e.g. agriculture sanitary and forestry inspections), creating local bodies that can report illegal activity and receive support in case of threats made against them, as well as empowering communities to take stock of, monitor, survey and protect their forests (Chapela, 2018). Community monitoring and surveillance in the Mexican context is fundamental for biodiversity conservation in forests, and represents an opportunity to improve capacity, reduce illegal operations, create jobs and monitor the progress of programmes and operations.

The case of the forestry sector is a particular one, since it can be often seen from a purely economic, or a purely environmental, perspective. There is a need to reconcile these two views. In this context, efforts for mitigation under REDD+ are an opportunity to integrate adaptation and biodiversity perspectives with economic

benefits, as well as contributing to a more effective use of resources. These initiatives may also be important to diversify production and sound use of non-timber forest products.

Timber and forest management approaches in the future should combine and adapt traditional forest management, multiple-use management, ecosystem management and landscape management concepts, to the specific conditions of ecosystems and communities, using an approach that promotes adaptation and mitigation to climate change. There are communities that already have an adequate level of awareness in some of these concepts, who could transfer their experiences to others. In the same way, reforestation efforts need to shift from quantity to quality, through biodiversity and climate smart plans that promote reforestation for restoration and resilience. Successful stories of the collective management of natural resources in *ejidos* and agrarian communities can be found across Mexico and proves that entrusting forests to local communities can bring a wide range of benefits, if the right conditions are met. In particular, there must be sufficient internal capacity for administration, technology application and conservation of ecosystem services. It is also important to ensure that the conditions for ownership of *ejidos* and participation in decision-making are more inclusive of women.

The Mexican government, agrarian nuclei, academia, civil society and the private sector have taken steps towards better management of biodiversity in forests. The country has ingredients to become a global leader in biodiversity conservation. A number of experiences demonstrate that managing forests in a sustainable way, to produce benefits for local communities and society in general, is possible, but requires effort and a more active transfer of concepts from policy to the field. The forestry sector will need to be accompanied by all of society in this effort. More than ever, our paradigms as a society need to change – from an intensive resource-based society to one that is sustainable and, above all, that appreciates and interacts better with nature. COVID-19 may have provided the grounds for these, as people have increasingly realized the benefits of forests and ecosystems as part of a healthier world, but the momentum needs to be maintained.

7. Peru

Cesar Sabogal

Forestry Consultant, Lima, Peru (former FAO Forestry Officer for Forest Management)

7.1. CONTEXT

Peru is a so-called megadiverse country and has forests covering almost 72 million ha, placing the country ninth in the world in terms of forest extent (CEPLAN, 2011)[184]. Forests in the Amazon basin, the dry areas of the Pacific coast and the inter-Andean valleys cover more than half of the national territory. These forests are essential for meeting daily food, energy, shelter and human health needs, particularly so for the nearly 333 000 Indigenous Peoples living in the Peruvian Amazon. Of the total population, nearly 30 percent in Peru relies on forest resources for cooking and 10 percent for shelter (FAO, 2014). Forests also provide a variety of other important ecosystem services, such as habitat provisioning, erosion control, water regulation, carbon sequestration, and recreation and cultural values (Alova, Orihuela and Karousakis, 2018).

A significant proportion of the Amazonian humid forests are part of the territory of native communities (11.5 million ha, 16.7 percent) and protected areas (PAs) cover 18.3 million ha (26.4 percent). Approximately 22 percent of Amazonian forests do not have legal status or rights, which limits their potential for legal and sustainable use, while exposing them to a greater probability of deforestation and illegal logging (MINAM, 2016a).

Forest plantations do not yet represent an important forest resource nationwide. The extent of the accumulated reforested area in the country is estimated at ~1 million ha (FAO, 2020b), mostly located in the highlands on rather small, community-owned areas (Guariguata *et al*., 2017). Commercial tree plantations barely cover 40 000 ha, but there is a growing interest from the private sector to expand the area with native and exotic tree species.

Peru has already lost around 10 million ha of forests to deforestation, mainly driven by agriculture and illegal mining. From 2001 to 2018 alone, the country lost 2.285 million ha of its natural forests, mostly in the Amazon region. The annual forest loss over the period 2015–2018 is estimated at 153 246 ha (FAO, 2020b).

Land use change for small-scale agriculture and livestock, expansion of commercial activities such as agribusiness, biofuels, mining and oil extraction, and illicit activities such as crops associated with drug trafficking, i.e. coca, poppy (UNODC, 2006), timber extraction and illegal mining, especially gold (Blades and Moher, 2006) are the main drivers of deforestation (Box 1; SERFOR, 2018). Over the past decade or

[184] https://news.mongabay.com/2014/08/a-paradise-being-lost-perus-most-important-forests-felled-for-timber-crops-roads-mining/

BOX 1.

Threats and root causes of forest and biodiversity loss

Direct threats to biodiversity and tropical forests:

- *Deforestation and land-use change* (e.g. for palm oil).
- *Overexploitation* (e.g. timber resources: about 80 percent of all commercial timber harvested, sold and exported from Peru is illegal; faunal overharvesting, particularly of larger ungulates and primates; Cuba, 2013; Collyns, 2016).
- *Illegal and informal gold mining* (operations take place within protected areas, their buffer zones, or indigenous territories; between 50 000 and 70 000 ha may have been destroyed over the past several years).
- *Infrastructure as a direct threat* (mega-project construction – dams and roads – in the Amazon basin catalysed by the Initiative for the Integration of the Regional Infrastructure in South America (IIRSA) and the Peru–Brazil energy agreement).
- *Habitat degradation* (degradation of critical habitats for species conservation resulting from illegal mining, cultivation of illicit crops, land-use change, land and river contamination).
- *Urban markets and mass production*.

Root causes of forest and biodiversity loss:

- *Environmental governance* (Peru's environmental governance capacity is currently unable to cope with the fast economic, social and environmental changes taking place).
- *Infrastructure* (the expansion of infrastructure in forested areas threatens tropical forests and biodiversity, but may be mitigated to some extent by effective governance that includes local participation).
- *Migration and population growth* (internal migration from rural Andean areas is an important threat to tropical forests and biodiversity in Peru).
- *Undervaluation of tropical forests and biodiversity* (forest biodiversity conservation or sustainable use cannot compete with conventional deforestation-based land uses such as oil palm cultivation).
- *Climate change* (leads to ecological changes that are predictable in general terms, but unpredictable at the local level and over shorter time frames).

Source: de Queiroz, J.S., Silva, F., Ipenza, C., Hernick, C., Batallanos, L., Griswold, D. & Rogers, A.E. 2014. Peru tropical forest and biodiversity assessment. US Foreign Assistance Act, Section 118/119 Report August. Washington DC: USAID. 142 pp.

Notes:

Cuba, M. 2013. Amazon degraded lands prompt new bushmeat hunting trends – Hunting and consumption of bushmeat may constitute the main source of protein for rural families. **CIFOR News**, 19 August 2013. https://forestsnews.cifor.org/18595/amazon-degraded-lands-prompt-new-bushmeat-hunting-trends?fnl=es

Collyns, D. 2016. Wildlife for sale: An illegal activity out of control in Peru? Mongabay report. 14 December 2016. https://news.mongabay.com/2016/12/wildlife-for-sale-anillegal-activity-out-of-control-in-peru/

so, the country has experienced increasing demand for land, mainly for commercial agriculture in the Amazon to expand commodities such as coffee, cocoa and high-yield oil palm (MINAM, 2016a). The deforestation of the Amazon has not only resulted in serious erosion of the biological diversity, it is also affecting the regional climate and contributing to global climate change (Alvarez Alonzo, 2019).

The main causes of forest degradation are selective logging, roads and gold mining in the Amazon, and overgrazing and soil erosion in the coastal and Andean ecoregions (SERFOR, Biodiversity-Peru and ICRAF, 2018). It is estimated that the area affected by degradation through selective logging is as much as the area deforested. Furthermore, roads opened for timber extraction also serve as access roads for settlers (RAISG, 2015).

Although the country has made significant progress in recognizing the land and forest rights of Indigenous Peoples in law, there is limited progress implementing the titling of collective rights on the ground. As such, more than 20 million ha of the Peruvian Amazon claimed by Indigenous Peoples remain untitled. This increases the risk of deforestation and degradation threatened by tourism, mining, illegal logging and infrastructure projects[185].

Peru has identified and mapped 8.2 million ha in need of restoration, of which more than 6.3 million ha were rated high to very high priority (Yalle and McBreen, 2018; Roman *et al*., 2018). Some years before, the Government committed to the restoration of 3.2 million ha of degraded and deforested land, in line with the Bonn Challenge and Initiative 20x20. The national restoration target has recently been set at nearly 1.8 million ha.[186] Restoration efforts so far have been directed to address the effects of deforestation, overgrazing and erosion, with the most common restoration strategy being tree planting, followed by agroforestry (including silvopastoral systems) and, to a lesser extent, pasture management and tree plantations combined with natural regeneration and assisted natural regeneration (SERFOR, Biodiversity-Peru and ICRAF, 2018).

7.2. BIODIVERSITY POLICY AND FOREST POLICY AND REGULATIONS

Peru is a signatory to most international treaties, protocols and conventions that have a bearing on tropical forests and biodiversity. There are eight national laws and 20 national institutions that are concerned with tropical forests or biodiversity, or both (de Queiroz *et al*., 2014). The sustainable use of the country's natural resources and the obligation to conserve biodiversity and protected natural areas is enshrined in the Political Constitution of Peru (Alova, Orihuela and Karousakis, 2018; de Queiroz *et al*., 2014).

Forest-related policy guidelines in the National Environmental Policy (MINAM, 2010) aim "to promote the sustainable and integrated management of forests, prevent the reduction and degradation of forests and their resources, conserve and increase the forest cover – with its biodiversity and environmental services – and the productive capacity of ecosystems, privilege the integral use of forest resources, promote reforestation, strengthen control and surveillance with community and citizen participation, and avoid deforestation of natural forests".

[185] The Tenure Facility: https://thetenurefacility.org/country/peru/
[186] https://infoflr.org/countries/peru

Peru has a dense body of policies and regulations on biodiversity conservation in forests (**Table 1**). The National Strategy on Biological Diversity, published in 2001, established as a priority for the forestry sector "to develop the potential of timber and non-timber resources and of wildlife, by managing forests and promoting their restoration with native species, and boost forest plantations for industrial purposes and agroforestry in order to generate employment and reduce the pressure on primary forests and improve the provision of environmental services" (CONAM, 2001). Most actions concerning forests in the National Strategy on Biological Diversity are under its strategic line 2 "Integrate the sustainable use of biodiversity in the productive sectors", and strategic objective 2.4 "Promote the management and sustainable use of forest resources".

However, the National Strategy on Biological Diversity and forest management regulations are not as well linked as they should be. The original NBSAP (valid until 2018)[187] did not achieve much progress. In 2021, an updated NBSAP (MINAM, 2021) was released with "strategic objectives and targets to address and reverse the … problems identified around biodiversity in the country". In this instrument there are specific forest-related targets and actions to be completed by 2030.

In the National Strategy on Forests and Climate Change (MINAM, 2016a), the focus is mainly on deforestation and the conservation status of forests and reforestation, but biodiversity is not explicitly incorporated. Particular attention is given to reduce the vulnerability to climate change of forest landscapes and the populations that depend on them, especially Indigenous Peoples, poor farmers and vulnerable groups, through improving their resilience and adaptive capacity, and considering and revaluing their traditional knowledge. The NDC (MINAM, 2016b) considers measures for adaptation that include: 1) valorisation of ancestral practices; 2) sustainable conservation practices in national PAs; 3) ecosystem restoration; 4) supervision and control; 5) generation of strategic chains within and outside communities; and 6) technological improvements for the sustainable use of forests. In relation to NDC measures for mitigation, there are eight related to forests, of which two are related to conservation, three to management, two to reforestation and agroforestry, and one to rights allocation. There are no specifics on forest biodiversity in the measures. According to stakeholders, these will be developed by the responsible institutions (MINAM, SERFOR, SERNANP), and hence are work in progress. One critique is that foresters were not consulted on how much forest management could contribute to reducing emissions (for instance, through the application of reduced impact logging techniques) and measures to improve the design and implementation of forest management plans or, in the case of indigenous communities, their Life Plans (Ecosphere+, 2019; Lemelin, 2020). Another critique is that the NDC were not grounded in reality.

The National Forest and Wildlife Policy (MINAGRI, 2015) explicitly mentions biodiversity in its five thematic axes, including the identification of species of forest biodiversity, their sustainable use and the benefits of their conservation, both in products and services, as well as in the processes for their integration into markets,

[187] www.cbd.int/doc/world/pe/pe-nbsap-v2-es.pdf

including the recovery of traditional knowledge. The Forest and Wildlife Law and its Regulations (Regulation for Forest Management, Regulation for Wildlife Management, Regulation for the Management of Forest Plantations and Agroforestry Systems, and Regulation for Forest and Wildlife Management in Native and Peasant Communities (SERFOR, 2015) include various biodiversity-related elements in natural forests, planted forests, agroforestry systems and with regards to wildlife and other natural ecosystems (**Table 1**).

In 2016, the country published guidelines for the restoration of forest ecosystems and other wild vegetation ecosystems that include the recovery of biodiversity in degraded areas (SERFOR, 2018). Restoration is understood as the "process for the recovery of a degraded, damaged or destroyed area, ecosystem or landscape for the purpose of resuming the ecological path, maintaining the resilience, conserving the biological diversity and restoring the functionality of ecosystems and landscapes" (Roman *et al*., 2018).

Threatened species

The number of threatened species in Peru is increasing. As of 2013, 44 percent of plant species and 8 percent of animal species assessed by IUCN in Peru were threatened (de Queiroz *et al*., 2014). The link with forest biodiversity is stronger with regards to legislation on the management of threatened species and invasive species. Peru is a party to CITES and currently the country has 469 (MINAM, 2014a) and 2 895 species of wild fauna and flora, respectively, included in the CITES Appendices[188]. Peru has a National Strategy to reduce the illegal trafficking of wildlife species (SERFOR, 2017), as well as various agreements incorporated into the Forest and Wildlife Law and its Regulations. Other relevant agreements include Ramsar, the Inter-American Convention for the Protection and Conservation of Sea Turtles[189] and the Convention for the Conservation and Management of the Vicuña[190].

Government action

The NBSAP (MINAM, 2014c) mentions several strategies and actions undertaken by the government in line with the national and international policies and agreements on biodiversity conservation:

- a better valuation of ecosystem services;
- the positioning of businesses related to native biodiversity under the criteria of environmental, social and economic sustainability (biotrade model)[191];
- the promotion of community forest management (CFM); and
- the development of innovative proposals for the financing of initiatives for the conservation of forests and biodiversity.

There are also instruments aimed at the sustainable *in situ* use of natural resources

[188] https://cites.org/eng/app/index.php

[189] www.fisheries.noaa.gov/national/endangered-species-conservation/inter-american-convention-protection-and-conservation-sea

[190] www.ecolex.org/details/treaty/convention-for-the-conservation-and-management-of-the-vicuna-tre-000102

[191] https://wedocs.unep.org/handle/20.500.11822/25911;jsessionid=2B6A7B38E493BCAD6C159B0521F2AB80

and biodiversity in the country, such as conservation concessions, ecotourism concessions, non-timber forest concessions and forests on Indigenous Peoples and local communities (IPLC) lands, which together cover more than 20.5 million ha (MINAM, 2014c).

Another important traditional activity in terms of using forest biodiversity is sustainable logging, whose current benefits for IPLCs are still considered small compared to its estimated potential. For this reason, the State has proposed a comprehensive reform of the legal and institutional framework to enable the strengthening of public and civil society capacities in order to conserve and sustainably use forests under adaptive management practices, i.e. through an ecosystem approach and management models that consider multiple aims, realities, users and visions, as well as criteria that respect cultural diversity and promote the active participation of IPLCs. Although serious problems of unregulated deforestation and illegal logging persist, there are also very positive experiences of certified forest concessions and CFM, which herald a better future for Amazonian forests (MINAM, 2014c).

Among opportunities for the conservation of biodiversity, it is important to highlight the effective participation of IPLCs, coordinated management among sectors and regions, reinforcement of respect for land tenure, and the consolidation of instruments of national conservation systems such as SINANPE[192], regional conservation systems, Ramsar sites, private conservation areas and the National Forest Conservation Program[193]; the latter having the purpose of guaranteeing the conservation of 54 million ha of forests through indigenous reserves. In addition, there is the titling of the territories of IPLCs that add up to more than 12 million ha, within which there are also highly conserved ecosystems (MINAM, 2014c).

Public policies attempt to reconcile the objectives of biodiversity conservation, primarily focused on National PAs, with the major objectives of forest management and biodiversity conservation in the National Forest and Wildlife Heritage, and some associated values (such as food security). For instance, the forest legislation explicitly considers biodiversity in the forest zoning categories and the allocation of forest use rights (such as concessions). An important point in the forest regulations is the promotion of multiple uses, providing incentives to activities related to resource use, biodiversity protection, carbon sequestration and landscape management.

The report prepared in 2018 for the OECD "Mainstreaming biodiversity and development in Peru: Insights and lessons learned" (Alova, Orihuela and Karousakis, 2018) analyzes – based on documentation and interviews – and documents the progress made by the country to integrate biodiversity into decision-making at different levels of the government and in various sectors of the economy, as well as the challenges that remain and lessons learned. According to this study, Peru has made important strides that should help facilitate biodiversity mainstreaming (Alova, Orihuela and Karousakis, 2018).

- *Creation of an enabling institutional and legal framework* (creation of the Ministry of the Environment in 2008 and its auxiliary agencies; development

[192] www.gob.pe/institucion/sernanp/campa%C3%B1as/4340-sistema-nacional-de-areas-naturales-protegidas-por-el-estado

[193] www.bosques.gob.pe

of a legal framework to support the implementation of biodiversity-focused policies, e.g. the Forestry and Wildlife Law (2011) and its four regulations; the Prior Consultation Law (2011) that makes it mandatory to conduct consultations with Indigenous Peoples prior to developing new legislation that may affect their territories and rights).

- *Signs of emerging policy coherence across key national strategies* which are instrumental to reciprocal mainstreaming (NBSAP; biodiversity considerations reflected in the Peru 2021 Bicentenary Plan – a long-term national development agenda, and the National Plan for Productive Diversification).
- *Incipient efforts to more sustainably use biodiversity within sector activities* (e.g. promoting sustainable biodiversity-friendly agroforestry practices; government's commitment to develop a formal sustainably-managed forestry sector, particularly for combating illegal logging).
- *Productive collaboration with development partners* (bilateral and multilateral cooperation assisting the government in the implementation of policy instruments, providing financing, and technical assistance; and also contributing to improve inter-ministerial coordination and private sector engagement).

Challenges

Biodiversity policies are highly sectoral, which complicates biodiversity mainstreaming. The 2018 OECD report (Alova, Orihuela and Karousakis, 2018) highlights a series of challenges or areas that impede implementation and require continued effort to improve mainstreaming at the national level.

- The lack of legal land tenure and the large size of the informal sector in agriculture, mining and forestry often lead to unregulated land-use changes, which in turn trigger biodiversity loss. A large share of forest area is unclassified, falling outside any legal and administrative control, while the vast majority of farmers have no land title.
- The limited technical and administrative capacity of the public service, particularly at the sub-national level, is aggravated by high personnel turnover.
- Gaps in the current quality and coverage of biodiversity-related data collection and management, which impede policy planning and implementation. In particular, the often fragmented and scattered nature of data makes it difficult to build a robust case for biodiversity mainstreaming across the economy.
- Prioritization of biodiversity within government budgets remains limited, creating a large funding deficit. To an extent, the low level of public investment can be explained by the lack of implementable projects, and a disconnect between policy planning and public investment decisions.

Gaps in policy and legal framework

According to the experts consulted for this report, the following issues and barriers came up with regards to the policy and legal framework.

- *Concepts and terms*. There is confusion with the term conservation, often understood as protection – when in reality it is sustainable use. This can act as a

barrier, e.g. the Ministry of Economy and Finance may reject a project from the national forest authority SERFOR, if it includes conservation, as this is under the mandate of the Ministry of the Environment (MINAM).

- *Complex legislation, not focused on implementation*. The legal framework is solid and comprehensive, but very complex and with little sense of reality for implementation. The country is committed to meeting goals, but which are isolated or disconnected from the realities on the ground (e.g. in the case of the NDCs; the regulations on floodplain forests not allowing local people, including the poorest in the Amazon, to use resources). This shows a lack of integration between environmental policies and strategies and the economy.
- *Overregulation and excessive paperwork.* The regulations and administrative procedures for the approval process of management plans for non-timber forest products (NTFPs) or to obtain sanitary authorization for a bioproduct discourage forest users to diversify and invest in forest-based businesses.
- *Lack of specificity in the regulations*. There are no specifics in many biodiversity-related regulations about how to comply with the requirement. For instance, despite the fact that forest regulations are about 200 pages long, they lack specificity about how forest management should be planned and applied; the detail is legal rather than technical. The ambiguity of many regulations leaves the concessionaire or community to figure out and use their own criteria.
- *Limited users' capacity.* The cost implications for compliance with existing regulations and specific requirements concerning biodiversity conservation in forest management operations are prohibitive for most forest users. For instance, many contract-holders (e.g. concessionaires) do not have the financial means to incur additional costs in their operations, e.g. to lower the diameter for tree inventories or implement silvicultural interventions, among others.
- *Bad application of existing regulations*. This outcome can be seen, for instance, in the way mechanisms for granting forest use rights are used. The Regional Government of Loreto is titling public forest areas to settlers, allocating lots of between 20 to 100 ha, granting so-called temporary permits to log without any restriction[194,195].
- *Lack of, or no updated indicators for forest biodiversity*. The relevant government institutions are still defining which indicators to use for biodiversity conservation in forests or how to update the existing indicators.
- *Conflicting views and sectoral policies*. There are conflicts in the way sectoral policies are implemented at the subnational level. For instance, the Ministry of Agriculture does not directly promote the expansion of the agricultural frontier, but it is interested in increasing crop productivity. This should also be reflected at the regional level, but it is not. For instance, in the Amazonian region of San Martín, both the forest zoning and agroecological zoning are used by the regional government as a basis to designate the uses in the territory. However,

[194] https://perusupportgroup.org.uk/2020/08/indigenous-organisations-serve-injunctions-to-stop-resumption-of-logging-in-reserves/

[195] www.iwgia.org/images/publications/new-publications/Peru_Deforestation_in_Times_of_Climate_Change_Dec_2019.pdf

the Regional Agricultural Directorate does not comply with the Ministry of Agriculture guidelines, since they continue to encourage deforestation by recognizing forest land possessions even if these are within the permanent production forests.

- *Low political interest*. Biodiversity conservation and sustainable use are not high on the agendas of the national and especially the regional governments. This is reflected, for instance, in the definition of land categories such as permanent production forests, whose delineation was mainly driven by the government interest to include as much area as possible of natural forests for the forest concession system established in the early years of this century.
- *Limited institutional capacity*. There is limited capacity to comply with biodiversity commitments due to weak institutions and weak governance. The lack of political will, timely decision-making and clear policies contribute to this. This in part reflects the dispersion of responsibilities for forest matters across more than one ministry.
- *Insufficient budget and illicit activity*. There is already enough legislation on forest protection and conservation, but an insufficient budget to implement changes. On top of this, there is corruption and division of functions at the national, regional and local levels.

Many of the challenges documented in the report by Alova, Orihuela and Karousakis (2018) still have not been effectively addressed by the leading institutions.

7.3. ROLE OF INDIGENOUS PEOPLES AND LOCAL COMMUNITIES IN FOREST BIODIVERSITY MANAGEMENT

The Peruvian legislation stands out for being pro-indigenous, with a wide range of tenure and use rights granted to communities. Indigenous Peoples' rights are incorporated into the law for different forms of territorial zoning, forest management at different scales, the right to titling and exclusive use of ecosystem services.

Compensation mechanisms for native communities conserving biodiversity in forests are formally included in the NBSAP and the NDC. In practice, however, there are problems. According to the Tenure Facility[196], the land rights of Indigenous Peoples have not been a political priority, particularly where they collide with expansion plans for tourism, extractive industries and infrastructure. Lack of capacity and resources within regional government institutions, indigenous organizations and communities is also an obstacle to progress.

Community forest management (CFM)[197] has not received the necessary attention from the State. The regional units for CFM included in the Forestry Law have not been implemented since its approval. Adequate access to information, technical assistance and financing is almost non-existent. Nevertheless, numerous studies on indigenous forest use systems and a specific regulation for native and poor farmer communities in the Forestry Law do exist. However, in practice the planning documents required by the authorities maintain the conventional concepts for harvesting by type of resource over defined areas. As such, they do not embrace

[196] https://thetenurefacility.org/
[197] https://dar.org.pe/ndc-manejo-forestal-comunitario-su-importancia-avances-y-retos/

multi-use landscape-scale management, where timber and non-timber products, fauna for food and medicinal purposes, medicinal plants, fishing and other resources are used. This means that ancestral knowledge is not incorporated. Therefore, a holistic, integrated management system would allow greater conservation and use of biodiversity, by seeking an economic and environmental balance aimed at meeting the needs of Indigenous Peoples.

The interest of many native communities is largely focused on non-timber forest resources, which represent their most valued resource. However, the legal framework for using, processing and commercializing NTFPs discourages formalization, due to the costly administrative procedures needed to comply with the regulations (e.g. formulation and approval of a management plan). In the case of forest concessions for Brazil nut or *castaña* (*Bertholletia excelsa*), the regulations allow timber harvesting of up to 5 m^3 per hectare. The management of both *castaña* and wood, nonetheless, face unnecessary complications. This multiple-use approach needs more technical support and supervision, and less restrictive regulation.

7.4. INSTITUTIONAL ARRANGEMENTS

The main government institutions with mandates concerning biodiversity conservation and sustainable use in Peru are the National Forest and Wildlife Service under the Ministry of Agricultural Development and Irrigation; the Ministry of the Environment and its two specialized bodies, the National Forest Conservation Program for Climate Change Mitigation and the National Service of Natural Areas Protected by the State; the Agency for the Supervision of Forest Resources and Wildlife[198]; Regional Governments; and the Research Institute of the Peruvian Amazon[199]. For reference, according to the report "Peru Tropical Forest and Biodiversity Assessment", there are 20 national institutions concerned with tropical forests and biodiversity (de Queiroz *et al*., 2014).

The National Commission on Biodiversity was created by the Ministry of the Environment as a public-private body for advice and consultation on biodiversity. It has a multisectoral and interdisciplinary nature, in which the representatives of relevant Ministries, regional governments, the private sector, the academic sector, non-governmental organizations and Indigenous Peoples propose, recommend and agree on policies, actions and measures to effectively comply with the provisions of the CBD and related treaties (such as Ramsar, CITES, CMS), as well as current national regulations on the matter[200]. As a coordination body, it meets regularly, including through a number of technical groups focusing on various themes, such as agrobiodiversity, protected areas or urban biodiversity (Alova, Orihuela and Karousakis, 2018). The Ministry of the Environment maintains multi-stakeholder fora for certain themes such as ecological–economic zoning and forest zoning, conservation plans for wildlife species and a working group for *Cedrela* species. One of the coordination spaces is the CITES Peru Working Group, where these two authorities, along with other State entities, meet to coordinate activities related to the

[198] www.fao.org/south-south-gateway/database/detail/en/c/346518/
[199] www.fao.org/south-south-gateway/database/detail/en/c/346412/
[200] See: www.minam.gob.pe/conadib/quienes-somos/

implementation of CITES in Peru. The Ministry of the Environment also works with the regional governments through public investment projects in the formulation of investment guidelines for Andean forest conservation, recovery of native species, and valuation of palm trees, among others.

Over the past decade, Peru's institutional framework for biodiversity has undergone significant transformation reflecting improved coordination between ministries and strengthened governance of forest and water resources (OECD/ECLAC, 2017). However, there is still a lack of definition of roles and responsibilities in the overlapping policy domains which leads to potential duplication and conflicts of interest (Alova, Orihuela and Karousakis, 2018; de Queiroz *et al*., 2014). As mentioned by Pautrat, Torres and Samaniego (2010), the forestry sector lacks "an articulated and coherent institutional framework that weighs, in its true dimension, the importance, magnitude and complexity of the resources that it seeks to preserve and administer".

During consultations with experts, the following issues and barriers came up with regards to the institutional framework:

- *Institutional fragmentation*. The institutional framework is fragmented. Production forests and protection forests fall under different ministries creating an institutional barrier and resulting in poor articulation and coordination between the main institutions with competencies on forest biodiversity, and a lack of an integrated vision between conservation and production or sustainable use. For example, in the flooded forests, which cover more than 15 million ha in the Amazon, there are seven institutions that have a mandate on themes related to forestry, environment, waters, production and defence. As no joint vision, strategy and action can be coordinated, the result is poor governance and a lot of illegal activities.
- *Poor communication and collaboration*. This is an important barrier among institutions with mandates at the national and subnational level, generating conflicts and considerable delays. Lack of trust and misunderstanding tend to generate negative attitudes towards national authorities, which can sometimes appear coercive towards regional authorities. Some regional authorities do not see that they have to comply with national laws. This is a structural problem exposing challenging issues related to the incomplete decentralization process in the country.
- *Overlapping functions.* There is an overlap of functions between ministries in the management of biodiversity at the national and regional level. For instance, in San Martín, the jurisdiction of the Regional Environmental Authority sometimes overlaps with those in charge of forest management.
- *Ineffective participation*. The working group on forest biodiversity remains almost inactive. A further issue is that representatives are not those who make decisions. As there is no budget allocated from the participating institutions towards their own commitments, in the end it is the Ministry of the Environment that implements the decisions and responds to international commitments. It seems that other spaces for discussion (e.g. roundtables)

involving government bodies, NGOs and other relevant actors are weak and face difficulties to properly operate.

- *Lack of human and financial resources for implementation*. Regional governments lack the human and financial means to assume the institutional responsibilities to implement the strategies and actions for biodiversity conservation.

7.5. EXPERIENCE OF FOREST BIODIVERSITY MANAGEMENT IN PERU

There are numerous local experiences involving indigenous communities, small-scale extractors and farmers, and the private sector demonstrating how forest biodiversity can be conserved, while sustainably used and valued through processing and commercialization (e.g. Reátegui and Valencia, 2008; Sabogal and Casaza, 2010; Gaviria and Sabogal, 2013; SERFOR, Bioversity – Perú and ICRAF, 2018). For this report, the following five experiences were selected, which were mainly inspired by the contributions received from the consultees (**Table 1**).

TABLE 1
List of mainstreaming experiences and their sources

Experience	Contributor
Andean forest restoration and conservation	Roberto Kometter, HELVETAS/ Andean Forest Programme (PBA)
Private forest company efforts to conserve and restore biodiversity in degraded Amazon forests	Jorge Cantuarias, Bosques Amazónicos SAC (BAM)
Public-private partnership to conserve and add value to a multipurpose Amazonian palm, aguaje (*Mauritia flexuosa*)	Dennis del Castillo, Research Institute of the Peruvian Amazon (IIAP)
Biodiversity protection in a well-managed production forest: Maderacre	Nelson Kroll, Maderera Rio Acre SAC (MADERACRE)
Conservation agreements as a socioenvironmental tool to mainstreaming biodiversity conservation in development: Alto Mayo in Peru	Luis Espinel, Conservation International - Peru

Source: Author's own elaboration.

Andean forest conservation and restoration

The Andean forests – running mainly through five countries (Venezuela, Colombia, Ecuador, Peru and Bolivia) – constitute the most extensive ecosystem in the tropical Andes, covering more than 37.2 million ha. This mountain formation – found generally between 1 500 and 3 500 m a.s.l. – plays a strategic role in soil and water protection, biodiversity conservation, as well as in preventing landslides, buffering weather events and sequestering carbon. Centuries-long human occupation and economic activities have severely reduced this forest ecosystem and associated wild vegetation across most of its geographic distribution (e.g. Chepstow-Lusty *et al*., 1998). In Peru, the Andean landscapes are mostly highly degraded by overgrazing, fuelwood collection, fires and soil erosion, and increasingly suffer from water scarcity and landslides. As such, conserving and recovering biodiversity is one of the priority objectives for landscape-scale restoration in the Andean region.

Peruvian regional governments in this region, notably of Cusco and Apurimac, are promoting restoration and conservation projects in the upper basins using native tree species of social and economic value (such as of the genera *Cedrela*, *Escallonia*, *Polylepis*). NGOs are also actively engaged in fighting climate change while recovering native forest and agrobiodiversity in the highlands. The following story, from Acción Andina (Andes Action),[201] illustrates this with the use of emblematic native tree species. Growing at altitudes of up to 5 000 m, *Polylepis* forests, comprising 28 recognized shrub and tree species endemic to the mid- and high-elevation regions of the tropical Andes, are a significant source of water in the headwaters of the Amazon. Crucial to fighting climate change, they absorb mist from the clouds and can transform dry, eroded landscapes into wetlands and habitat for threatened species. Due to a long history of deforestation for fuelwood and grazing, only 500 000 ha of severely fragmented stands remain across the Andes. Now high Andean communities, mainly Quechua-speaking Inca descendants, are coming together to bring them back and restore their watersheds. Acción Andina is scaling up a time-tested, 19-year community reforestation model. Developed and implemented by the Peruvian conservation non-profit Asociación Ecosistemas Andinos[202], it has resulted in the planting of over 3 million native trees, including 1.5 million Polylepis[203]. Restoring forests which grow just below the glaciers is a cost-effective solution for long-term climate resilience. In addition, restored *Polylepis* forests offer a refuge for those species of birds and mammals able to survive climate change by successfully migrating to higher ground.

Conservation and restoration of biodiversity in degraded Amazon forests

Bosques Amazónicos SAC (BAM)[204] is a private company with forest operations in the Ucayali and Madre de Dios regions. Its purpose is to protect and restore the value of the Amazon ecosystems to mitigate the effects of climate change, conserve their biodiversity, and contribute to the economic, social and environmental development of Peru. The company's private property in Campo Verde, Ucayali (24 443 ha of contiguous land located 45 minutes from the city of Pucallpa) is engaged in a native species reforestation programme to recover degraded soils and restore secondary forests in the area. Around 11 000 ha have been separated as a private protection area largely covered by so-called *bajiales* or floodplain forests. Given the threats posed by agricultural activities, logging or deforestation, this initiative is of considerable importance for biodiversity conservation, biological studies and ecotourism, precisely because they are so close to the city. The company has launched a science programme to evaluate the ecological value and importance of the ecosystems located on its properties. Its activities include carrying out: (i) a continuous inventory of biodiversity with an emphasis on threatened or endangered species, varieties with restricted distribution, organisms new to science, among others; (ii) an ecological characterization of the property's natural communities (primary, secondary, *bajial*

[201] www.globalforestgeneration.org/Accion-Andina
[202] www.ecoanperu.org/cuscoeng.html
[203] www.salesforce.com/plus/series/Ecopreneurs/episode/episode-s1e3
[204] www.bosques-amazonicos.com/en

forests, intervening areas) which will allow for a precise zoning with a view to their conservation and eventual sustainable use; and (iii) the restoration of the most valuable natural environments of the property with a view to promoting the return of wildlife species and encouraging natural processes, such as pollination, restoring the balance of ecosystems, and fostering ecotourism. A 2020 expedition by a team of biologists from the Centre for Ornithology and Biodiversity[205] to Quinillal, a remote area in the Campo Verde property, registered 36 species included in the CITES appendices. One of the most interesting species found during the assessment was *paujil* (*Mitu tuberosum*), the razor-billed curassow, a bird the size of a large turkey that prefers floodplain forests where it is now rare due to hunting pressure.

Public-private partnership for management of *Aguaje* (*Mauritia flexuosa*)

Aguaje is a cultural food whose staple-like role in contemporary urban nutrition links the cities of today with the jungle. Its fruits are used mainly for regional consumption, such as fresh fruit, ice cream and soft drinks. As a result, this harvest directly supports more than five thousand families, where women play a leading role in the whole market chain. Peru has more than 5 million ha of *aguajales* or *aguaje* groves (made up almost exclusively of *Mauritia flexuosa* palm), that constitute the largest carbon stores in the tropics, with more than 600 tons of CO_2 per hectare[206]. They are key to mitigating the effects of climate change and host a unique biodiversity. However, they are threatened by the indiscriminate felling associated with harvesting the fruit. In the *aguajales* closest to the riverbanks there are already very few female trees as a result of intensive harvests through logging. This palm has many benefits, not only for its high content of vitamin A (beta-carotene), but also for other nutritional properties in its fruits and pollen, and its fibre, as well as being part of the diet for wildlife. The palm can be harvested, without cutting the stipe (trunk), thus keeping the peatlands underneath intact.

In 2019, the national government established a conservation agreement with the private company AJE[207] for the sustainable use of *aguaje* with certain access conditions for investment. Under this public–private alliance, the company commited itself to organize local communities in the Pacaya Samiria reserve in the Loreto region, for the sale of *aguaje* fruits to make a drink that is available on the market, thus giving this resource added value. These communities harvest their natural resources in a sustainable way, without cutting down the palm tree or degrading the forest, i.e. an essential requirement imposed by the company. According to AJE's Chief Sustainability Officer, the company "seeks to create a 'triangle' of sustainability with a product that is beneficial to the health of the consumer, thanks to its natural components; that helps to conserve Peruvian tropical forests; and that positively promotes the local communities involved for economic benefits". The Ministry of the Environment has also issued a license to the company for using the trademark "Aliado por la Conservación" and the National Forest Conservation Program

[205] www.corbidi.org
[206] https://ampaperu.info/manejo-sostenible-del-aguaje-en-la-concesion-para-conservacion-dos-de-mayo-de-muyuy
[207] www.ajegroup.com/en/sostenibilidad/natural-revolution/

has an initiative to include Amazon fruits in the "Qali Warma"[208], a government-led programme to feed school children. With the purpose to serve as a model of public investment, the Ministry of the Environment and the Amazonian Regional Governments have formulated guidelines for public investment projects in order to promote the value of Amazonian palm fruits.

Biodiversity protection in a well-managed production forest: Maderacre

Maderacre[209] - Maderera Rio Acre S.A.C. was established in 2002 as a family company that promotes the sustainable development of the forest and the surrounding communities. Its forest concession of 220 000 ha in Tahuamanu, Madre de Dios has FSC, as well as VCS[210] and CCB[211] certifications. It sells bonds for avoided deforestation under REDD+. Since 2020, Maderacre has also incorporated the FSC Ecosystem Services Procedure[212] to help verify its positive impacts on biodiversity and carbon emissions. Madre de Dios, in the Peruvian Amazon, is not only one of the most biodiverse areas on the planet – it is also home to fragile species that require extensive forest areas to thrive in. The region's rich natural ecosystems have been historically impacted by illegal logging and hunting, deforestation for agriculture, and illegal gold mining. According to FSC, "The company has successfully demonstrated positive impacts in four main categories. First, by increasing the property area under full conservation status by 57 percent, from 7 014 ha in 2014 to 10 995 ha in 2019. Second, by protecting the entire forest management unit against illegal hunting and logging, resulting in less illegal deforestation. Third, by diminishing the area degraded by reduced impact harvesting operations, which helps maintain the regeneration capacity of the forest. And last, by maintaining the number of species present in the property. A study conducted in 2017 registered an impressive 135 tree species in the concession area, including 17 key species tracked for their importance to this ecosystem."

Conservation agreements as a socioenvironmental tool for mainstreaming biodiversity conservation in development: Alto Mayo in Peru

In the Alto Mayo basin – one of Peru's most deforested areas – nearly 30 percent of the original tropical forest has disappeared. Scarce economic opportunities have led the indigenous Awajun people to rent out their community lands, contributing to more than 60 percent of the deforestation. As a result, unsustainable agricultural practices and the use of agrochemicals have caused soil degradation and water contamination. Since 2013, Conservation International Peru[213] has been working with two Awajun communities – Shampuyacu and Alto Mayo – in an integrative approach to community-based territorial planning and development. Through the implementation of conservation agreements, this initiative aims to strengthen

[208] www.gob.pe/qaliwarma
[209] https://maderacre.com
[210] https://verra.org/project/vcs-program/
[211] www.climate-standards.org/ccb-standards/
[212] https://fsc.org/en/for-forests/ecosystem-services
[213] www.conservation.org/peru

the Awajun communities' governance and capacity to sustainably manage their territories and help reduce deforestation.

In the Shampuyacu community, the project is creating the enabling conditions for the marketing of up to four different plant species as herbal teas. The work has supported women in the design of a new business model for medicinal plants to be commercialized as herbal teas. In addition to being a source of potential income, this work offers an opportunity to rescue traditional knowledge while providing alternative products to the growing market for medicinal plants. The project will also directly benefit families with growing, harvesting and commercializing medicinal plants, through the conservation and restoration of the ecosystem and finally with improved incomes and access to increased health benefits. This is a pilot business model that, if successful, will generate interest in neighbouring Awajun communities, potentially further scaling its impact and reach.

In the Alto Mayo, the project is engaging with the community through conservation agreements with community members, but also with the migrant farmers. The activities aim to: conserve their primary forests; restore and enrich forest fallows and their agroforestry systems with traditional plants; improve the environmental and biodiversity attributes in the community; improve livelihoods; rescue and transfer indigenous knowledge; and halt deforestation. As such, the aim is to create land conservation and restoration that could contribute to climate change mitigation efforts and be adopted by national programmes.

7.6. LESSONS LEARNED

Policy and regulations

- *Policy integration*. Biodiversity must be a cross-cutting issue in the forestry and the agricultural sector with policies duly integrated at the three government levels: national, provincial and communal.
- *Realistic regulations*. The technical issues and cost implications to comply with existing regulations and specific requirements concerning biodiversity conservation in forest management operations need to be taken into account when formulating those instruments.
- *Need for practical, easy to follow guidelines*. Practical guides could be developed with standards and indicators for applying the required management practices, while considering local knowledge.

Institutional framework

- *Institutional change*. It is necessary to have a broader functional institutional framework fostering a change of attitude and a culture of collaboration between sectors and government levels.
- *Broader, integrated vision for forest management*. There is a need to advocate for a more integral vision for forest management by exploring options to add value to standing forests, for example, generating income through non-timber forest products, ecotourism, etc. for organized communities, or promoting

ecotourism within timber concessions to make it visible that well-managed concessions conserve biodiversity. Biodiversity conservation and carbon sequestration could be integrated as a strategy.

- *Community support*. A more direct and efficient assistance to indigenous communities is needed for multiple use sustainable forest management. The State must support and accompany communities in preparing and implementing their forest management plans.
- *Support to businesses valuing biodiversity*. A more supporting role is needed from the State for entrepreneurial initiatives to value biodiversity and to unlock barriers for fair trade with forest biodiversity products.
- *Capacity for monitoring and data management*. There is a need to strengthen institutional capacities for monitoring, data management and timely information sharing.
- *Incentives for promising models*. It is necessary to have well-designed and operationalized institutional (e.g. quality information, training) and financial (e.g. preferential purchase of products, tax exemption) incentives for different forest management models. Explore the option for a nested system of incentives and recognition (labels) at the national, regional and communal levels, and seek public, private and philanthropic funds. State action must lead, fostering a structure in which the private sector can participate.
- *Coordination platforms*. Need to strengthen national and regional coordination platforms or roundtables, ensuring the effective participation of academia, research institutes, relevant NGOs and forest users.
- *Alliances*. Need to strengthen alliances between institutions (policy-makers, academia, private sector) to explore and develop alternatives for biodiversity conservation and sustainable use in forests, plantations and agroforests.
- *Communication policy.* The benefits of biodiversity need to be convincingly communicated. How does forest biodiversity contribute to people's daily lives and wellbeing? Forest users need to be motivated, for example, by making explicit the benefits of implementing good forest management practices. Along the same lines, certification reports could be properly disseminated as a basis for more effective ways of communicating to decision-makers and society about the biodiversity that is being maintained in well-managed forests.

Technical aspects

- *Quantification of forest biodiversity*. The contribution of biodiversity to the productive sectors has not been sufficiently valued and disseminated. For instance, quantifying the forest–water–agriculture/food security relationship could motivate land users to change deleterious practices. "Politicians and decision-makers need to have numbers to react and act". "There is a need for more holistic economic valuation approaches that incorporate a broad spectrum of the environmental goods and services provided by forest ecosystems" (de Queiroz *et al*., 2014).
- *Traditional knowledge*. Need to promote policies and programmes to

incorporate the traditional knowledge of native communities into forest management.

- *Dissemination of successful experiences*.
- *Educational activities.* Reinforce environmental education at all levels (primary through technical/professional) using new, innovative IT-based tools and hands-on activities in the field (e.g. forest schools).
- *Support research*. More research is needed on native species (ecology, seed production, silviculture, management, utilization), nutritional value of forest biodiversity, valuation and impact studies on biodiversity in managed forests, among others.

8. United Kingdom of Great Britain and Northern Ireland (Scotland)

Vanessa Burton and Alice Broome

Forest Research, Northern Research Station, Roslin, Midlothian EH25 9SY, United Kingdom

8.1. CONTEXT

Scotland was among the first nations to adopt an ecosystem approach, with a suite of progressive environmental policies coming into force after the devolution of the Scottish Government in 1999. Despite reforestation in recent decades, woodland cover at 19 percent (Stagg, 2021) in Scotland remains low in both a historical and European context (Thomas *et al*., 2015), with the European average sitting at around 37 percent (Eurostat, 2021). The total area of woodland is 1 467 000 ha, with 1 000 000 ha of this being managed by the private sector and the remaining 467 000 ha under public ownership (Stagg, 2021). Native woodlands, especially ancient woodland, have a high biodiversity value (Hayhow *et al*., 2019), but are thought to cover just 5 percent of total land area (Scottish Government, 2019).

Since devolution, the Scottish Government has produced a range of progressive policies including the Biodiversity Strategy (Scottish Executive, 2004), Climate Change Act (Scottish Government, 2009), three iterations of a Land Use Strategy (Scottish Government, 2011, 2016, 2021b) and the Land Reform (Scotland) Act (Scottish Parliament, 2016) and Community Empowerment (Scotland) Act (Scottish Parliament, 2015). Together these policies advocate for forest management which both mitigates and adapts to climate change, conserves and restores biodiversity, and links people to the land. Multi-functionality is consistently mentioned as a primary objective for Scottish land use. Despite these objectives, environmental problems continue, with pressures from agriculture, upland management, land use change, habitat fragmentation, pollution, invasive species and climate change having caused a 14 percent decline in average species' distribution and a 49 percent decrease in species abundance, with 11 percent of species threatened with further decline (Hayhow *et al*., 2019). Conflicting objectives between stakeholders and a lack of understanding of exactly how to achieve desired multi-functionality are cited as among the reasons for failure to meet these policies (Burton *et al*., 2019).

8.2. FOREST POLICY AND REGULATIONS

Policies reflecting the need to account for biodiversity in forestry have been in place in Britain as a whole since 1991, with the first edition of Scotland's Forestry Strategy

and the first Scottish Biodiversity Strategy published in 2000 and 2004, respectively (Forestry Commission, 2017; Quine, Humphrey and Watts, 2003). Scottish policies set out objectives for both biodiversity and forestry, the links between which are highlighted in the following sections. The Scottish policies themselves respond to several international policies and commitments. These include the UN Strategic Plan for Forests 2017–2030, which outlines global forest goals, in particular increasing the area of protected forest and sustainably managed forests worldwide. The CBD aims to increase the area, connectivity and integrity of natural ecosystems, supporting healthy resilient populations of species, while the New York Declaration on Forests includes ambitious, quantitative forest conservation and restoration targets. Goals within the European Union Forest Strategy for 2030[214] state that European forests should be protected and restored. Among the outcomes of the UNFCCC twenty-sixth Conference of the Parties (COP26) in Glasgow in 2021 was the commitment made by over 140 leaders, to work together to halt and reverse forest loss and land degradation by 2030 (Glasgow Leaders Declaration of Forest and Land Use, 2021[215]). As shown by the First Minister's statement[216], Scotland's international reputation for its natural capital and its supporting policies were highlighted at COP26. Besides the subsequent launch of a GBP 55 million Nature Restoration Fund[217], the Ministerial statement on responsible investment in natural capital reflects the ambition that, as the forest resource and carbon investment increases, a values-led and highly integrated market with equitable sharing of wide-ranging benefits can be delivered. These benefits include biodiversity improvements, while sharing encompasses local communities as well as wider society.

NBSAP: Links to forest management laws and regulations

Scottish Biodiversity Strategy (2004) and post-2020 statement of intent (2020). Ensuring that Scotland's internationally renowned nature is highly valued and secure is the main objective of the Scottish Biodiversity Strategy (Scottish Executive, 2004; Scottish Government, 2020). Built upon the ecosystem approach, the application of the strategy is focused at the river catchment (landscape) scale and is necessarily cross-sectoral. Delivery is promoted through protected area (PA) management, habitat restoration and incentivizing actions for nature conservation. Following on from the European Union exit, the Legal Continuity Bill[218] aims to keep the same level of European Union protections and regulations for the environment, including protected habitats and species legislation.

Scotland's Forestry Strategy (2019–2029). A 50-year vision with a 10-year framework for action, Scotland's Forestry Strategy (Scottish Government, 2019) sets out an approach to expanding, protecting and enhancing Scotland's forests and

[214] https://environment.ec.europa.eu/strategy/forest-strategy_en#documents
[215] https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/
[216] www.gov.scot/publications/first-ministers-statement-cop26/
[217] www.nature.scot/doc/nature-restoration-fund-nrf-priorities-action-guidance-funding-applicants
[218] www.parliament.scot/bills-and-laws/bills/uk-withdrawal-from-the-european-union-legal-continuity-scotland-bill

woodlands, so that they deliver greater economic, social and environmental benefits to Scotland's people, now and in the future. Key to the strategy is the aim for more forests to be managed sustainably. As conservation of biodiversity is integral to sustainable forest management (SFM), there is a strong link between this and the Biodiversity Strategy. Together these policies aim to tackle the twin challenges of biodiversity loss and climate change, supporting "transformational changes in upland and woodland stewardship".

UK Forestry Standard (2017) – the UK government's approach to SFM. Scotland's Forestry Strategy uses the UK Forestry Standard as the benchmark for SFM (Forestry Commission, 2017). It states that "the conservation of biodiversity is an essential part of sustainable forest management". For species conservation, the principles of SFM align with the requirements of multilateral agreements on biodiversity, with wildlife legislation and with policy strategies responding to these instruments at the European, United Kingdom and country (e.g. Scotland) level (JNCC and Defra, 2012). The UK Forestry Standard influences the processes by which forestry is regulated. It determines the conditions under which felling licenses are granted, government grants for forest management are awarded, and long-term forest plans are approved. Grants, licenses and planning approvals are the main ways in which private woodland management is regulated by the government. The UK Forestry Standard also applies to the management of the public forest estate[219,220,221,222] and is reflected in the strategies and delivery plans produced by Scotland's public estate management body[223]. Conditions stipulated under these regulatory processes help steer the forest manager to carry out activities to enhance and restore semi-natural habitats, protect priority (often endangered) species, and reduce and mitigate against threats to biodiversity. Although currently under revision[224], the UK Forestry Standard is likely to continue to be strongly influenced by the international commitments raised above.

Incorporation of endangered species protection into forest management

Species protection legislation provides a key mechanism for delivering conservation for individual species and their habitats (Favero *et al*., 2014). Targets to halt the loss of biodiversity and reverse previous losses through action targeted at species and habitat is outlined in the National Biodiversity Framework, i.e. the overarching document to the Scottish Biodiversity Strategy (Scottish Executive, 2004) and around 3 000 species (marine and terrestrial) are identified as having some level of legal protection in the UK (JNCC and Defra, 2012). Of these, circa 200 species are associated with woodlands in Scotland (Broome *et al*., 2019). Only a quarter of the woodland species

[219] www.forestryengland.uk
[220] https://forestryandland.gov.scot
[221] https://naturalresources.wales/about-us/what-we-do/welsh-government-woodland-estate/?lang=en
[222] www.daera-ni.gov.uk/forest-service
[223] https://forestryandland.gov.scot
[224] www.gov.uk/government/publications/the-uk-forestry-standard#full-publication-update-history

are represented by better known taxa (birds, mammals, amphibians, reptiles and vascular plants), whereas the remainder are species of invertebrates, non-vascular plants (bryophytes, lichens, liverworts) and fungi, which tend to be more cryptic and less well studied (Scottish Government, 2021b; Broome *et al*., 2019). Conservation action is dependent on legislation, licensing and clauses attached to grants and other habitat management programmes, e.g. Scottish Rural Development Programme 2014–2020[225], Wildlife and Countryside Act (UK Government, 1981). Besides the overarching expectation that all woodland management will be conducted according to the UK Forestry Standard, there are more explicit ways in which endangered species can be incorporated into forest management.

- All woodland owners have personal responsibility to work within the wildlife laws when managing woodlands, e.g. not killing or harming (wild birds and specially protected animals); avoiding damage to breeding sites (all wild birds) and for European protected species[226] of animals, including resting places, or any form of disturbance of these species; picking, uprooting or destroying any specially protected plant species and European protected plant species (Scottish Parliament, 2004; UK Government, 2021).
- There is an expectation that a duty of care for all priority listed (often endangered) species will be exercised on all public land, and on private land by managers in receipt of public funding, e.g. woodland management grants (Scottish Parliament, 2011).
- Certain conservation actions are still incentivized through targeted grants usually associated with woodland creation or management, but these can also be targeted specifically for woodland species, e.g. woodland improvement grants[227] to benefit priority species (Forestry Commission, 2017).

Forestry sector specific guidance of good practice is provided by the Scottish Government to assist understanding and adherence to the law and to grant and license conditions. The intended outcome of this guidance is to strike a balance, which seeks to avoid reckless or deliberate damage or disturbance, but does not place unreasonably onerous and impractical restrictions on legitimate land management practices. The guidance[228] recognizes that to help conserve viable protected species populations, there is often a need to sustain active management of woodlands in order to provide a long-term variety of habitats. The best way to avoid harmful impacts on protected species, while at the same time taking opportunities for enhancing biodiversity, is through good forest design and forward planning, which is then carried through to management.

Forest managers are expected to be able to demonstrate that all reasonable steps have been taken to avoid damage or disturbance to protected species and to comply with legislation and guidance. In Scotland, there is a system of monitoring compliance

[225] www.gov.scot/policies/agriculture-payments/scottish-rural-development-programme-srdp
[226] www.nature.scot/professional-advice/protected-areas-and-species/protected-species/legal-framework/habitats-directive-and-habitats-regulations/european-protected
[227] www.ruralpayments.org/topics/all-schemes/forestry-grant-scheme/woodland-improvement-grant/
[228] https://forestry.gov.scot/forests-environment/biodiversity

with grant and license requirements and with the wildlife laws (performed by officers from Scottish Forestry[229] and NatureScot[230], Scotland´s nature agency), and specifically for wildlife crime through a partnership approach between police, land managers, conservation groups and other non-governmental organizations. There is also a facility for members of the public to directly report wildlife crime to the police[231].

A yearly report is provided to the Scottish Government on wildlife offences as required under the Wildlife and Natural Environment (Scotland) Act 2011 (Scottish Parliament, 2011). This shows trends in crime incidents, indicating that action is taken on average against 75 percent of reports each year (4 year average; Scottish Government, 2022). However, in 2019–2020, very few appeared to be related to forestry activities. Surveillance on performing duty of care for biodiversity is undertaken through a three-yearly report to the Scottish Government (Scottish Parliament, 2011). An analysis in 2016 of recent reports showed that 44 percent (61) of the 139 public bodies in Scotland engaged in reporting their responsibility towards biodiversity conservation (Daly, Fenn and Miller, 2015).

Local community rights

How are community rights incorporated into forest management?

Scotland has one of the most concentrated patterns of land ownership in the world, a legacy of feudal tenure (McMorran, 2016), as well as the largest average forest holding size in Europe, dominated by large estates and absentee investors (Forest Policy Group, 2011). The Land Reform and Community Empowerment agendas aim to improve governance of the possession and use of land to facilitate an economically successful, socially just and environmentally sustainable Scotland (Land Reform Review Group, 2014). The Land Reform (Scotland) Act (Scottish Parliament, 2003, 2016) established the Scottish Land Commission[232], which among other things, gives communities the right to buy land, in particular, to further sustainable development (Wong *et al*., 2015). The Community Empowerment Act (Scottish Parliament, 2015) further enables the purchase of abandoned, neglected or detrimental land (defined as harming, directly or indirectly, the environmental wellbeing of a community), and community participation in decision-making. The National Forest Land Scheme was another important mechanism for facilitating community ownership (or lease and management) of land by communities and environmental NGOs and allowed community acquisition of Forestry Estate Scotland land[233] (Wong *et al*., 2015). This has since been replaced by the Community Asset Transfer Scheme[234]. Together, this legislation has contributed to diversification of the pattern of land

[229] https://forestry.gov.scot/
[230] www.nature.scot/about-naturescot
[231] www.scotland.police.uk/advice-and-information/wildlife-crime/
[232] www.landcommission.gov.scot/
[233] www.forestresearch.gov.uk/publications/action-for-the-environment-on-scotlands-national-forest-estate/
[234] https://forestryandland.gov.scot/what-we-do/communities/community-asset-transfer-scheme

and forest ownership, with increasing public, NGO and community ownership. Currently some 196 415 ha of Scotland is community owned, i.e. less than 3 percent (McMorran, 2016). Local community control has been found to be a powerful catalyst and positive agent for rural development (McMorran and Scott, 2013). Case study analysis has shown that it can reconfigure current management approaches, often re-working traditional land uses. Examples have included changing emphasis in deer management (including increased culling, deer counts and habitat monitoring), restructuring conifer plantations, and planting native woodland (Lawrence and Ambrose-Oji, 2015).

According to the Community Woodlands Association[235], there are currently around 200 community woodland groups in Scotland, collectively owning and managing forest ranging from ancient semi-natural woodlands to large conifer plantations and regeneration on urban brownfield sites. These are held under a range of tenure arrangements, including ownership, lease or management agreements.

In addition to community ownership and control, consultation is an essential part of the decision-making process. Forest management activities on the public forest estate are consulted on with local authorities and other land management organizations, as well as with local people and interested parties. This also applies to larger private or community schemes.

The first Land Reform Act (Scottish Parliament, 2003) also gave everyone rights of access over land and inland water throughout Scotland, subject to specific exclusions set out in the Act and as long as they behave responsibly (Wong *et al*., 2015). These rights are sometimes referred to as "freedom to roam". Behaving responsibly is defined by a code including "caring for the environment".

How does this relate to forest biodiversity management?

The Community Woodlands Association, an NGO, provides guidance on woodland management plans and long-term forest plans for existing and aspiring community woodlands. Management plan guidance includes recommendations to carry out inventories of fauna and flora within the woodland, as well as in non-wooded areas, such as waterbodies or unplanted open habitats. Woodland owners are also directed to the National Biodiversity Atlas[236] (the UK's largest biodiversity database for records on local species, habitats, among others) to inform their planning. Long Term Forest Plan (LTFP) guidance goes further for biodiversity, advising that all management must follow guidance set out in the UK Forestry Standard (Forestry Commission, 2017). This also emphasizes identifying any designated sites or features including Site of Special Scientific Interest[237] and National Scenic Area designations[238], as well as Ancient Semi-natural Woodland and Plantation on Ancient Woodland site status[239].

[235] www.communitywoods.org/
[236] https://nbnatlas.org/
[237] www.woodlandtrust.org.uk/blog/2019/03/sssi-definition/
[238] www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/national-designations/national-scenic-areas
[239] https://neenp.org.uk/natural-environment/ancient-semi-natural-woodland-including-paws-and-rnwas-habitat-definition

In addition, the Scottish Forestry Community Fund (2022–2023)[240] supports community groups to make use of the National Forest Estate. This fund has a strong focus on wellbeing, encouraging socially-focused activities and schemes, but also provides management resources.

There is therefore plenty of support and guidance available to community groups relating to biodiversity management. Nevertheless, it seems that there has been minimal evaluation of this to date. Many of the models of community forestry in Scotland to date have been economic (Lawrence and Ambrose-Oji, 2015). Biophysical evaluation data of community woodlands have predominantly focused on quantitative indicators of output, e.g. trees planted and area of woodland created (Lawrence and Ambrose-Oji, 2015). However, indirect measures suggest that there have been positive increases in perceptions of environmental quality for community woodlands (Lawrence and Ambrose-Oji, 2015).

Any change generated by communities will be set within locally prescribed narratives of sustainability (McMorran and Scott, 2013). Research in Scotland has identified a key divergence in stakeholder visions for land use, with My Land emphasizing community ownership versus Your Land which maintains the status quo in terms of concentrated land ownership (Valluri-Nitsch *et al*., 2018). This highlights a debate around land ownership and community involvement in decision-making. Depending on the perspectives of those involved, participation and community ownership could be seen to be either counter-productive for decision-making, or an essential principle of sustainable development, with participatory decision-making being seen as inherently beneficial. Due to different interpretations of sustainability and what that means to local communities, community ownership cannot always be assumed to be beneficial for biodiversity. If community control is prioritized, land management objectives will depend on the values of the community, and if protection and restoration of biodiversity are desired on a national level, then continued regulations, incentives and guidance for biodiversity management may be required for long-term sustainable development (Burton *et al*., 2019).

8.3. INSTITUTIONAL ARRANGEMENTS

The Forestry Commission for the UK was established in 1919, but forestry in Scotland has been devolved since the establishment of the Scottish Parliament in 1998, with full devolution coming into effect in 2019. Scottish Forestry is the government agency responsible for forestry policy, regulation, incentives, technical forestry advice and cross border arrangements (Yang, 2020), while Forestry and Land Scotland is responsible for managing public forests and woodlands. Both organizations are directly accountable to Scottish ministers. Having previously been located under different government ministries, as of 2021, biodiversity and forestry now fall within the jurisdiction of a single minister for Environment, Biodiversity, and Land Reform, supporting the Cabinet Secretary for Rural Affairs and Islands.

The Scottish Government is required to develop Scotland's Forestry Strategy (Scottish Government, 2019) with regard to a number of policies and protocols

[240] https://forestry.gov.scot/component/edocman/1404-community-fund-2022-to-2023/download?Itemid=0

including those relating to biodiversity, i.e. the Biodiversity Strategy (Scottish Government, 2020), climate change (Scottish Parliament, 2009), and land use (Scottish Government, 2021b). A key policy is the Land Use Strategy (Scottish Government, 2021b), which advocates for landscape scale action and regional spatial strategies, and aims to bridge cross-sectoral barriers. Linkages between landscapes, wider dynamic land uses and inclusive decision-making are integral for the long-term framework related to the expansion and sustainable management of Scotland's forests and woodland (Scottish Government, 2021b). A key landscape scale issue is deer management, which is a key concern for both biodiversity and forestry management in Scotland. High deer numbers significantly impact Scotland's natural heritage (Scottish Natural Heritage, 2016), preventing new woodland establishment and affecting woodland biodiversity through preferential browsing, which results in changes in habitat structure and the loss or suppression of understorey plants, climbers and ground flora, and the species which these components support. Management and monitoring vary based on Deer Management Groups, which aim to coordinate action across regions, with management either taking the form of fencing or culling to reduce deer numbers. Management and policy have been extensively reviewed in recent years (Scottish Natural Heritage, 2016; Pepper, Barbour and Glass, 2020). Current recommendations include ensuring that the Scottish statutory nature agency replaces Wild Deer Best Practice guidance (Scottish Natural Heritage, 2011) and has the capacity to respond and take effective action where there are unacceptable levels of environmental damage caused by deer.

The latest Land Use Strategy (Scottish Government, 2021b) aims to revitalize Regional Land Use Partnerships (RLUPs),[241] which are a requirement of the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 (Scottish Parliament, 2019; Yang, 2020). These aim to bring local people, land users and managers into regional or local partnerships to better understand land use issues and encourage better integration of land uses. To make these fora meaningful, stakeholder feedback has advised that these should: be truly representative of all sectors; prioritize public goods; clearly articulate regional needs; be part of a 'just transition'; and have strong facilitation and trusted intermediaries. The 'just transition'[242] is a central objective of the Scottish Government, emphasizing equality while achieving net-zero GHG emissions.

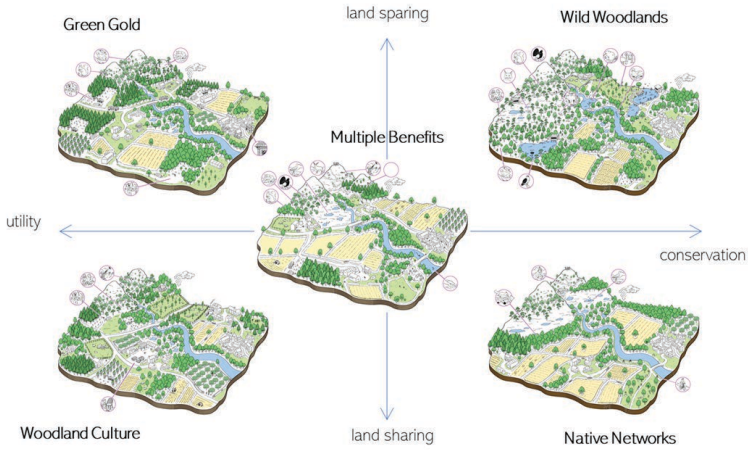
8.4. EXPERIENCE OF BIODIVERSITY MANAGEMENT

Research has characterized stakeholder views on Scottish woodlands into five visions or positive descriptions of ideal futures (Burton and Metzger, 2018; **Figure 1**). These articulate the wide variety of objectives and values associated with forests, woodlands and trees in Scotland, with a focus on woodland expansion. Biodiversity is mainstreamed differently within each vision, ranging from following United Kingdom Forestry Standard guidance as for example in the vision Multiple Benefits (Forestry Commission, 2017), conserving protected species and sites and connecting habitats via integrated habitat networks, to allowing natural processes to dominate

[241] www.ed.ac.uk/sites/default/files/atoms/files/land_use_partnerships_brief.pdf
[242] www.gov.scot/publications/transition-fairer-greener-scotland/pages/5

over large landscape scale areas (as in the visions Native Networks and Wild Woodlands), with emphasis on reintroducing species and allowing novel habitat regeneration.

FIGURE 1.
Biodiversity is treated differently by alternative visions.



Source: Burton, V. & Metzger, M.J. 2018. Five illustrated woodland expansion visions for Scotland. The University of Edinburgh. https://doi.org/10.7488/ds/2331.

Green Gold: biodiversity is balanced with other concerns – well-designed plantations maximize biodiversity benefits alongside production. Woodland Culture: biodiversity is valued and is treated sensitively, but is not the primary motivation – woods are primarily for people. Multiple benefits: well-designed productive woodlands maximize biodiversity benefits alongside production, while other woodlands are managed primarily for biodiversity conservation. Native networks: conservation of biodiversity is of primary concern. Woodlands have an important role in protecting and enhancing biodiversity and provide habitat for native and reintroduced keystone species (Forestry and Land Scotland, 2022).

Here we present short case studies of a number of different stakeholder groups and their experiences with biodiversity management.

Forestry and Land Scotland

The public forest estate in Scotland covers 640 000 ha, two-thirds of which is composed of a mixture of productive species plantations (around a half being the non-native Sitka spruce – *Picea sitchensis*), semi-natural woodland, and open habitats, e.g. blanket bog. Forestry and Land Scotland has a statutory duty to further the conservation of biodiversity across the entire estate and looks after 428 statutorily designated sites and species on sites covering 67 500 ha (Forestry and Land Scotland, 2022).

Biodiversity enhancement on the public forest estate is a key aim. The actions that Forestry and Land Scotland takes to underpin this focuses on management of the woodland resource in a way which is understood to confer benefits for biodiversity. These actions include increasing tree species diversity and woodland structural diversity, increasing the proportion of native tree species, increasing the deadwood resource and enhancing habitat connectivity (Kerr, 2019; Humphrey and Bailey, 2012; Humphrey *et al*., 2013). Special attention is paid to the management of high conservation value forests (HCVFs) which make up 30 percent of the public forest estate. These are composed of ancient semi-natural woodland (many statutorily designated), where protection and enhancement are largely implemented though deer control to reduce browsing damage, and in plantations on ancient woodland sites (PAWS) where planted exotic tree species are being removed to restore the original native conditions. A further 6 percent of the land is treated as natural reserves, managed in perpetuity with minimal intervention (Forestry and Land Scotland, 2020). Further actions attempt to address threats to biodiversity and include removal of invasive non-native species (e.g. *Rhododendron ponticum* from Atlantic broadleaved woodlands)[243], soil protection measures during harvesting, reducing grazing and browsing pressure, and water quality protection through riparian woodland management (Confor, 2020). By means of this general good forestry practice for biodiversity (Forestry Commission, 2017), Forestry and Land Scotland aims to discharge its biodiversity duty of care (Scottish Parliament, 2011).

In their Biodiversity Duty Report 2018–2020, Forestry and Land Scotland (2020) show how implementing biodiversity conservation is a core activity of their organization, while reconciling wildlife and habitats with operational activities is a daily and ongoing process for staff. The report describes how each of the five regions has a team of environmental specialists that collaborate with the staff involved in felling and planting trees, or building roads. How consideration of biodiversity is integrated into every stage of the policy, plan and delivery cycle is detailed in the report as follows:

Policy and Guidance. All management activities are carried out in accordance with a range of policies and guidance that ensure the protection, conservation and enhancement of biodiversity is a mainstream activity. All work is guided by the UK Forestry Standard (Forestry Commission, 2017). Staff follow a wide range of operational guidance, covering everything from protecting raptors and red squirrels during forest operations, to ensuring watercourses and soils are not degraded during road building or tree felling. All of these guidance notes are available to view on a public website[244]. Forestry and Land Scotland also has a range of in-house guidance notes that aim to reconcile forest management activities with the conservation of biodiversity and information on their website to showcase conservation work being undertaken[245].

[243] www.plantlife.org.uk/application/files/5014/8240/9392/Scotland_Atlantic_woods.pdf
[244] https://forestry.gov.scot/forests-environment
[245] https://forestryandland.gov.scot/what-we-do/biodiversity-and-conservation/wildlife-conservation

Planning. Forestry and Land Scotland invests significant time in planning land management to further the conservation of biodiversity. It is a complex process of engagement, analysis, design, discussion and agreement with stakeholders. The key output is the land management plan, which is produced for every large forest or group of small forests. These are the forest-level plans that translate the strategic plans and policies into land management. Identifying environmental and biodiversity priorities within the land management plan is an important part of the process, and each plan is written to further the conservation of these features. Engagement with stakeholders, such as the Scottish statutory nature agency, i.e. Forestry and Land Scotland, and NGOs, as well as with local people, is crucial to identify the most important environmental assets. This engagement is continued throughout the life of the plan, while the partnerships developed in the planning process continue to inform the conservation of biodiversity during implementation. In the period 2018 to 2019, Forestry and Land Scotland planners reviewed and updated land management plans covering 125 310 ha of Scotland's national forest. All of these plans incorporated actions to further the conservation of biodiversity.

Delivery. Forestry and Land Scotland carries out a wide range of forest and land management activities. To ensure these activities do not have an adverse impact on biodiversity, and to ensure opportunities to enhance biodiversity are taken, staff use a work plan system for all forest management and most civil engineering work. Staff with expertise in conservation and the environment contribute to all work plans ensuring that the staff conducting the forest operations are aware of the environmental constraints and opportunities. As such, environment staff carry out surveys prior to the commencement of operations, which means visiting or reviewing each site to identify important habitat features, such as deadwood, and marking the sites of protected species, such as raptor nests and badger (*Meles meles*) setts. They often deploy camera traps to ascertain whether dens and other features are being used by protected species. Subsequently, protected and priority species and areas of important habitat that are found during pre-operational surveys are recorded in a GIS-based database, which is used to inform operational planning and enact mitigation measures to protect biodiversity. Once a pre-operational site visit has been carried out, mitigation measures are written into the work plan. For example, an exclusion zone will be placed around a raptor nest, which means work cannot be carried out within that zone during the breeding season. Exclusion zones and timing restrictions on operational activities are two actions that are used frequently to protect biodiversity. Where necessary, work is conducted under licenses, which are issued by the statutory nature agency. These licenses require Forestry and Land Scotland to specify mitigation measures to minimize impacts on protected species.

Auditing. Forestry and Land Scotland is audited each year by an independent forest certification organization (currently The Soil Association)[246], as part of certification under the UK Woodland Assurance Standard[247]. This certification process provides important, independent reassurance that best practice in terms of its management of biodiversity is being implemented.

[246] www.soilassociation.org/
[247] https://ukwas.org.uk/

The representative interviewed for Forestry and Land Scotland has expertise in forest management, biodiversity conservation and local communities. Overall, they regarded that on the public forest estate, biodiversity conservation was effectively mainstreamed in forest management. Protected species were particularly taken into account in the work plans embedded in the forest management process, and with "most of the environment staff resources targeted towards carrying out these work plans". Protocols include pre-felling checks for protected species and inspection of forestry works for legal compliance. Furthermore, "native habitats and those designated for nature conservation are very well managed, with the condition of designated sites independently monitored by the Scottish statutory nature agency, of which 93 percent are in a favourable condition". With regard to the effective incorporation of cultural values and needs of local communities into forest management, our respondent commented that "Forestry and Land Scotland engages extensively with local communities through the local design plan process (e.g. via public meetings and making documentation available on the web), and takes note of views as part of this process." In addition, they said "there is always an attempt to accommodate views and local community requirements provided these are within operational bounds". An example was given: "If the objection relates to felling a commercial plantation, and the grounds of the objection are not sound, then it is unlikely to stop the operation taking place. However, it is always made clear the extent to which we do manage proactively for biodiversity across the estate". When questioned on the extent to which other ecosystem service values are incorporated into forest management, the answer was "less so at present, but this is changing". The interviewee qualified this by saying that water values are considered effectively through implementation of the UK Forestry Standard's forest and water guidelines, but other ecosystem services are only considered and noted in a general way, as there is no mechanism in place for these to be captured and clearly factored into planning decisions. "Forestry is still run largely on a fiscal basis and as a monetary value is only available for timber, only timber is included in the accounting. However, there is a change coming to value more ecosystem services, and senior managers are promoting this and so it is likely to be incorporated." Indeed, the lack of methods and corporate tools to support more than a timber price valuation of forests was a barrier to biodiversity conservation, which our respondent mentioned. In addition, "taking a more rounded assessment of the value of forests, i.e. following the ecosystem approach, is a policy objective, but there are barriers to implementation. Namely, the lack of practicable methodologies to value other ecosystem services and the methods to incorporate these formally into planning decisions are not currently embedded."

Two further barriers were suggested by the interviewee:

- Limitations on what can be done with the current forest resource: "It is through silviculture that most of the biodiversity benefits are delivered; targeted actions for particular species and habitats is the icing on the cake. The barriers to delivering most of the biodiversity benefits are inherent in the forest resource we have to manage in Scotland (i.e. a largely man-made habitat of fairly uniform tree species composition and age structure) and its capacity to undergo different silvicultural interventions."

- Resistance to changing plans once agreed through the planning process: "Although forestry is undertaken to meet multiple objectives, it is not always possible to meet all objectives in all places, and certain areas may be managed more for timber production and some areas more for biodiversity benefits. In areas where timber production is the main objective, there can be resistance for altering management plans to deliver for biodiversity. This sectoring of different areas for different objectives usually occurs at the planning phase and can be difficult to change should a biodiversity interest be identified later, unless ignoring that this biodiversity interest would be illegal."

Our respondent also thought that the policy and regulation of biodiversity management in forestry was sound, and reiterated that it was "the corporate methodological elements to reflect more than timber values in planning and decision-making", which are required. A final consideration was made – the need for patience, as in their experience, it can take time – "possibly 10 years" for science to change policy and for policy to be implemented in practice.

Private forestry sector

The Confederation of Forest Industries is a UK-wide membership organization which supports and provides a voice for sustainable forestry and wood-using businesses. They recently published a report, "Biodiversity, forestry and wood" (Confor, 2020), noting that the merits of native versus exotic trees has come to dominate much of the debate about forestry and biodiversity in the UK. They argue that the majority of forest ecology does not rely on particular species of tree, and the exotic species introduced for wood production have developed rich forest assemblages of their own. They draw together research which they use to support their argument that in certain contexts Sitka spruce forests show no significant difference in species richness compared to oak/ash woodland and facilitate woodland species, while supporting population expansion of many woodland birds.

A reported case study from the west coast of Scotland shows that hen harriers (*Circus cyaneus*) have increasingly been observed on larger restock sites of Sitka spruce in Mid Argyll and Mull, with sea eagles (*Haliaeetus albicilla*) nesting and hunting in numerous forests throughout Argyll (Confor, 2020). Forest managers are involved in monitoring golden eagles (*Aquila chrysaetos*) to understand what mix of production/native and woodland/open habitats might be best for prey availability. There is anecdotal evidence for increased raptors, black grouse (*Tetrao tetrix*), red squirrels (*Sciurus vulgaris*), and wood ants in Sitka spruce sites.

The representative consulted from the industry sector has expertise in forest and biodiversity policy. They felt that protected species are effectively protected in Scottish forests, noting that "production forests in the UK are actively creating and enhancing more habitat for protected species than they disturb", but added that "better dialogue between conservation organizations and forestry could improve wildlife management further". They noted that "forestry is the land use in which habitat protection is incorporated most strongly, including designated areas, riparian and wetland areas, deep peat, established native woodland, and control of disruptive

operations like felling, pesticide use and ground preparation. This is effectively maintained both through the state woodland creation/felling license/long-term forest plan regulations and annual independent auditing under the UK Woodland Assurance Standard, which underpins FSC/PEFC[248] certification."

The consultee had interesting insights in terms of how cultural values are incorporated into forest management, separating the "relatively young" forestry industry into three groups: nineteenth century estate forests ("most mature with a strong role in local economies"); twentieth century public forests ("playing the strongest role in UK forest culture and balancing production and environmental management"); and twentieth century private investment forests ("ecologically immature and bearing a legacy of inappropriate siting or design"). Furthermore, the consultee noted that a "lack of local engagement is a common criticism of both state and private forests", while feeling that "significant work is ongoing to improve stakeholder and community engagement", but that "this is under-invested compared with that in sectors such as energy or construction." A particularly interesting insight was that "there are probably more people in the UK with a stake in forests than in any other land sector. Large areas of state forests are owned on behalf of all the population, while many private forests are owned by pension or investment funds on behalf of hundreds or even thousands of people. This important financial stake that many people have in a rural industry is not widely recognised".

The key challenges noted were the views of conservation organizations, and an imbalance in regulation when compared to other sectors. The promotion of the idea that biodiversity does not use production forest is seen as unhelpful, shifting focus to "planting non-productive forests or converting production forests to non-production, rather than seeking opportunities to expand and improve biodiversity within production forests". Farming is held up as an example of a sector which has much less stringent regulations, with "farmers put off creating forestry where it could have combined production and habitat benefits".

In terms of opportunities, the report (Confor, 2020) argues that more native woodlands should be under management to improve biodiversity, for example, extracting wood to enhance forest structure, coppicing, and reducing grazing damage. Wood products from native woodlands are suggested as an income stream to fund management and conservation. Our consultee noted that as "lacking a traditional forest culture, there is huge scope for the UK to build a twenty-first century forest culture that is relevant to an urbanized society, with forests as places for recreation, opportunities for green investment, and providers of the materials required to build a circular economy. The biggest barrier to this is the strong anti-production culture of biodiversity organizations." An additional recommendation suggested was: "A pathway for construction companies to meet biodiversity net gain and carbon net zero requirements through the creation and management of new production forests that will supply their future materials while offsetting their present footprint".

[248] https://pefc.org/discover-pefc/what-is-pefc

Community Woodlands Association

Scottish community woodlands are hugely diverse, in terms of woodland type, scale and nature of community. The consultee approached for the community sector noted that "broadly speaking, environmental objectives (including biodiversity) have a high priority for the majority (if not all) community woodland groups relative to most private (or public) sector forest managers, albeit that in most cases delivering social outcomes ranks even higher."

The consultee focused on the main barriers and policy and regulatory changes needed, feeling that the existing Forestry Grant Scheme[249] "is too focused on woodland creation" and "not enough on management of existing forests and woodlands, so support is limited or targeted to designated sites". In addition, it was noted that the "designated site system isn't necessarily fit for purpose for broad biodiversity conservation, with too much focus on the "rare" and "special", so that secondary woodlands tend to be considered worthless regardless of how many species now live there, while individual species get fetishized (e.g. capercaillie)". An additional concern was that the "small scale of landholdings makes tackling some issues difficult without neighbour cooperation" and that high deer numbers continue to be an issue.

Central Scotland Green Network

The Central Scotland Green Network[250] aims to establish a high-quality green network that will meet a number of environmental, social and economic goals. It promotes an integrated habitat network, which will help habitats and species to be more resilient, providing wildlife corridors and a good quality landscape.

The consultee contacted for this sector has experience in biodiversity conservation and policy, and did not feel that "biodiversity is effectively mainstreamed into productive forest management, and certainly not productive forest creation". They observed conflicting policy objectives, with "high tree planting targets for climate reasons overriding other land management or biodiversity policies, even if the other land management could be peatland restoration which will do as much, if not more, for the climate".

"There are individuals and situations where it is done well, and things are getting better, but it is not yet the norm. I think protected species are usually considered in forest management, and the legal requirements to protect them exist, but it is rarely more than the legal minimum and only covers nationally protected species. General biodiversity improvements and locally important species are not often considered. I think that ecosystem services are being considered more, and awareness of connectivity is rising, but the best way to use productive forests in landscape scale connectivity is not well understood."

In terms of barriers, the consultee proposed that "a lack of knowledge and expertise among many forest managers", as well as "a lack of guidance on how to actually implement the good policy, or time and resources to change" prevented effective mainstreaming, stating that "it's too easy just to do what's always been

[249] www.ruralpayments.org/topics/all-schemes/forestry-grant-scheme
[250] https://centralscotlandgreennetwork.org

done". The main proposed change was to "have better communication between researchers and practitioners or better links between courses and training, so that there's better understanding between the two disciplines".

Cairngorms Connect

Cairngorms Connect[251] is a partnership of neighbouring land managers, committed to an ambitious 200-year vision to enhance habitats, species and ecological processes across a vast area within the Cairngorms National Park. Our consultee, with experience in forest management and biodiversity conservation, felt that there is "a lot of variation" in terms of how species are protected within production forests. For their project, there are "strong protocols to safeguard biodiversity", with "significant recording", "mapping of records" and "references to these records during management planning and implementation". They referenced the requirements via Scottish Forestry to produce long-term forest plans and carry out EIAs, as well as the requirement for habitats regulations appraisals[252] where there is potential for impact on rare or designated species or sites. Outside of these contexts, it was noted that "biodiversity interests are less-well protected". In terms of cultural values being incorporated into forest management, the consultee noted likely variation again, but felt that for their project they consult effectively around management plans, long-term forest plans and EIAs, following Scottish Government advice to involve communities in land management decisions that may affect them. They also incorporate ecosystem service values into their management approach, particularly in terms of CO2 storage and climate change resilience, but note that these benefits are "considered by different degrees according to land manager objectives".

The main barriers to biodiversity conservation in forest management were considered to be: timescale; spatial scale; the need to reconcile trade-offs; and risk of rushed actions having negative consequences. In terms of time, the "conventional 5–10 years for woodland grant schemes" was felt not to "recognize the effort required to establish woodland over sustained periods". Larger woodlands were noted to be better for biodiversity, and "more robust in the face of the climate emergency and associated risks such as fire, windthrow[253] and disease". "Reconciling conservation trade-offs between high value open ground species and habitats, and forest species and habitats" was a key area for concern, with the consultee noting that "in some instances we may be replacing one priority habitat (e.g. dry heath) with another (native woodland)", but that this is done "in consultation with the relevant agencies". The current "push for quick tree planting" was noted to "risk carbon emissions… compared to lower emissions associated with natural regeneration". However, it was also noted that "these [risks] need to be offset against the other gains from tree-planting, biodiversity benefits, increased catchment roughness, and associated benefits of flood alleviation and improved water quality".

In terms of policy changes, "forest establishment at scale" was viewed as key,

[251] http://cairngormsconnect.org.uk

[252] www.nature.scot/professional-advice/protected-areas-and-species/protected-species/legal-framework/habitats-directive-and-habitats-regulations

[253] In forestry, windthrow refers to trees uprooted by wind.

with this focusing on increasing connectivity at larger scales. Key to this were recommendations for connecting neighbouring landholdings to encourage actions at a catchment scale. Overall, "longer-term actions and commitments" were recommended for success.

8.5. SYNTHESIS AND LESSONS LEARNED

Scotland has well developed policies on both biodiversity and forestry, as well as high confidence in governance to implement regulations. There are statutory links between these policies, as well as a cross-sectoral Land Use Strategy aiming to bridge barriers (Scottish Government, 2021b). However, policy and a good regulatory framework alone does not ensure that conservation of biodiversity is effectively mainstreamed – it also requires capacity for management and funding for implementation.

For the public forest estate, we find that this is largely achieved, with strong adherence to legal requirements. With a relatively low percentage of woodland cover and few forest ecosystem types (i.e. compared to other case study nations), the transactional cost of complying with laws and regulations is not excessive and action for biodiversity conservation does occur. These are mostly mainstreamed through silvicultural and management choices, checks, and exploitation of opportunities. Within the private sector, experiences vary, with twentieth century investment forests (both private and public) leaving behind a potentially damaging legacy both for perceptions of the production forestry industry and for biodiversity (based on poor siting and/or design). Today the industry is regulated, but more could be done to break down barriers and fully integrate production objectives together with strong measures for biodiversity, in particular in terms of no longer seeing production and conservation as either/or. Community woodlands are often formed primarily around social objectives, but environmental concern and conservation or even restoration of biodiversity often appear to be central to achieving these. For both the community and environmental NGO sectors, there is concern that current policy and regulations are doing the bare minimum, and that only certain rare or priority species are prioritized, making it difficult to manage for wider or local aspects of biodiversity.

Currently, high level policy aiming to tackle both the biodiversity and climate crises mean that there are often conflicting objectives, with climate policy aiming to achieve net zero GHG emissions tipping the balance in terms of affecting current forestry policy, especially in the form of prioritizing grants for new woodland creation. This may have the effect of taking the focus away from biodiversity. Barriers to effectively implementing an ecosystem approach include difficulties in incorporating values other than timber (including biodiversity) into methods for decision-making. Debates around these issues are also currently set within the context of strongly sectoral and sometimes polarized views, with binary choices between native or non-native species, and production or conservationist values dominating arguments. This may be hampering important routes forward, with areas of common ground often being overlooked.

Significant opportunities exist to move away from these sectoral standpoints. The Land Use Strategy, revitalized in 2021 (Scottish Government, 2021b), aims to reinvigorate a number of regional land use partnerships. The core purpose of these

partnerships is to encourage thinking and cooperation between land managers and communities at a landscape scale, enabling discussions around land use decisions and integrating high level policy with local objectives. These could have a valuable role in helping the biodiversity and forestry sectors to become more integrated. In particular, more could be done to tackle the currently largely divided views of biodiversity professionals and production foresters. This could be achieved through the development of courses and training events which emphasize links and common ground. In terms of incorporating cultural values, there are opportunities to further promote community control of woodlands (increasing from the current 3 percent), together with improved stakeholder consultation around public and private forestry and its integration of biodiversity objectives, with opportunities to draw on lessons learnt from the renewables industry. In this way, the five different visions for Scottish woodlands, which all mainstream biodiversity in different ways, could be better accommodated and integrated (Burton and Metzger, 2018).

Acknowledgements

Many thanks to Agaba Mulumba for internally reviewing this case study.

9. References

Ahokumpu, A.-L., Auvinen A.-P., Pylvänäinen, M. & von Weissenberg, M., eds. 2014. *Fifth National Report to the Convention on Biological Diversity Finland*. Ministry of the Environment. 136 pp. www.cbd.int/doc/world/fi/fi-nr-05-en.pdf

Äijälä, O., Koistinen, A., Sved, J., Vanhatalo, K. & Väisänen, P., eds. 2019. Forest management recommendations (translated). Tapio publications. 252 pp. https://tapio.fi/wp-content/uploads/2020/09/Metsanhoidon_suositukset_Tapio_2019.pdf

Alova, G., Orihuela, J.C. & Karousakis, K. 2018. *Mainstreaming biodiversity and development in Peru: Insights and lessons learned*. OECD Development Co-operation Working Paper 45. 71 pp. http://files.pucp.edu.pe/departamento/economia/Jos%C3%A9-Carlos-Orihuela-Mainstreaming-BIodiversity.pdf

Alvarez Alonso, J. 2019. Forests and indigenous peoples facing climate change and globalisation. In: A. Chirif, ed. *Peru: Deforestation in times of climate change*. Lima, Peru. pp. 91–112. www.iwgia.org/images/publications/new-publications/Peru_Deforestation_in_Times_of_Climate_Change_Dec_2019.pdf

Alvarez-Icaza, P. 1993. Forestry as Social Enterprise. *Cultural Survival Quarterly,* 17: 45–47.

Anta Fonseca, S., Carabias, J., Díaz de León, A., Illsley, C., López, C., Robinson, D., Escamilla, E., Edouard, F., Ramírez, F., Merino, L., Chauvet, M., Ramírez, O., Alvarez, P., Obregón, R., Madrid, S., Purata, S. & Avila, S. 2008. Consecuencias de las políticas públicas en el uso de los ecosistemas y la biodiversidad. In: *Capital natural de México*, vol. iii: Políticas públicas y perspectivas de sustentabilidad. pp. 87–153. Mexico City, México: CONABIO. https://bioteca.biodiversidad.gob.mx/janium/Documentos/7416.pdf Accessed on 12/05/2021

Antinori, C.M. 2000. Vertical Integration in Mexican Common Property, Forests. Ph. D dissertation, University of California, 2000.

AP News. 2019. Mexico's indigenous Lacandon battle settlers over rainforest. https://apnews.com/article/4b066fcf65ee494ab36c144904994725 (Accessed on 12/05/2021).

Assies, W. & Duhau, E. 2009. Land tenure and tenure regimes in Mexico: an overview. In: J.M. Ubink, A.J. Hoekema & W.J. Assies, eds. Legalising land rights. Local practices state response and tenure security in Africa, Asia and Latin America. Leiden University Press, Netherlands. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1471-0366.2007.00162.x (Accessed on 12/05/2021).

Atlas forestier de la République Démocratique du Congo. 2021. https://cod.forest-atlas.org/?l=fr

Auvinen, A.P., Kemppainen, E., Jäppinen, J.P., Heliölä, J., Holmala, K., Jantunen, J., Koljonen, M.L. *et al.*, 2020. Impact Assessment of the Implementation of National Strategy and Action plan for the Conservation and Sustainable use of Biodiversity in Finland (2012–2020) Finnish Environment Institute and Natural Resources Institute Finland. 44 pp. www.cbd.int/doc/nr/Finland.pdf.

Ávila Akerberg, A., Aranda Cardoso, E. & Hernández González, K. 2016. La gobernanza forestal y los objetivos de biodiversidad, cambio climático y desarrollo sustentable en México. Polea, CBD and Globe International. www.polea.org.mx/descargas/gobernanza.pdf (Accessed on 12/05/2021).

Bender, S. & Tekle, M. 2019. Community action for biodiversity and forest conservation and adaptation to climate change in the wild coffee forests (CAFA). In W. Leal Filho, J. Barbir & R. Preziosi, eds. *Handbook of Climate Change and Biodiversity*. pp. 79–92. Springer International Publishing. https://doi.org/10.1007/978-3-319-98681-4_5

Bahuchet, S., ed. 1999. The situation of indigenous peoples in tropical forests. Pilot report. Programme Avenir des Peuples des Forêts Propicales. http://lucy.ukc.ac.uk/Sonja/RF/Ukpr/Report_c.htm (2004).

Berhanu, M. 2009. Ethiopian forest conservation, development and utilization: past, present and future. Proceedings of a workshop. *Ethiopian forestry at crossroads: The need for a strong institution*. Occasional Report 1.

Bezaury-Creel, J., Gutiérrez-Carbonell, D. & Remolina, J. 2009. Áreas naturales protegidas y desarrollo social en México. In Capital natural de México, vol. II. Estado de conservación y tendencias de cambio. Mexico: CONABIO. pp. 385–431. www.researchgate.net/publication/236150170_Areas_naturales_protegidas_y_desarrollo_social_en_Mexico (Accessed on 12/05/2021).

Bienestar. 2021. En marzo se pagarán tres meses conjuntos a integrantes de Sembrando Vida. Press release. Mexico: Secretaría de Bienestar. www.gob.mx/bienestar/prensa/en-marzo-se-pagaran-tres-meses-conjuntos-a-integrantes-de-sembrando-vida-javier-may (Accessed on 11/05/2021).

BIOCOMUNI. n.d. Sobre el Monitoreo Comunitario de la Biodiversidad, BIOCOMUNI. http://biocomuni.mx/sobreBiocomuni/ (Accessed on 13-05-2021).

Biodiversity Center Japan. 2012. National Biodiversity Strategies and Action Plans 2012-2020. www.biodic.go.jp/biodiversity/about/initiatives/files/2012-2020/01_honbun.pdf (in Japanese)

BIOFIN. 2016. Peru achieves new milestone, incorporating biodiversity in general investment policy. *Biodiversity Finance Initiative News*, 5 August. www.biodiversityfinance.net/news/peru-achieves-new-milestone-incorporating-biodiversity-general-investment-policy. Accessed 30 March 2017.

BirdLife International. 2012. Eastern Afromontane Biodiversity Hotspot. www.cepf.net/sites/default/files/eastern_afromontane_ecosystem_profile_final.pdf, Retrieved March 2021

Blades, R. & Moher, P. 2021. Pictures from outer space reveal the extent of illegal gold mining in Peru. *The Conversation*, May 6. https://theconversation.com/pictures-from-outer-space-reveal-the-extent-of-illegal-gold-mining-in-peru-159416

Bray, D.B. & Merino-Pérez, L. 2002 The rise of community forestry in Mexico: History, concepts, and lessons learned from twenty-five years of community forestry timber production. Mexico City, Mexico: SEMARNAT, The Ford Foundation. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.470.4775&rep=rep1&type=pdf (Accessed on 12/05/2021).

Broome, A., Bellamy, C., Rattey, A., Ray, D., Quine, C.P. & Park, K.J. 2019. Niches for Species, a multi-species model to guide woodland management: An example based

on Scotland's native woodlands. *Ecological Indicators*, 103: 410–424. https://doi.org/10.1016/j.ecolind.2019.04.021.

Brudvig, L.A., Damschen, E.I., Tewksbury, J.J., Haddad, N.M. & Levey, D.J. 2009. Landscape connectivity promotes plant biodiversity spillover into non-target habitats. *Proceedings of the National Academy of Sciences*, 106(23): 9328–9332. https://doi.org/10.1073/pnas.0809658106

Burgess, N., Küper, W., Mutke, J., Brown, J., Westaway, S., Turpie, S., Meshack, C., Taplin, J., McClean, C. & Lovett, J.C. 2005. Major gaps in the distribution of protected areas for threatened and narrow range Afrotropical plants. *Biodiversity and Conservation*, 14(8): 1877–1894. https://doi.org/10.1007/s10531-004-1299-2

Burton, V. & Metzger, M.J. 2018. Five illustrated woodland expansion visions for Scotland. The University of Edinburgh. https://doi.org/10.7488/ds/2331.

Burton, V., Metzger, M.J., Brown, C. & Moseley, D. 2019. Green gold to wild woodlands; understanding stakeholder visions for woodland expansion in Scotland. *Landscape Ecology*, 34(7): 1693–1713. https://link.springer.com/content/pdf/10.1007/s10980-018-0674-4.pdf

Carstens, M. 2016. Sami land rights: The Anaya Report and the Nordic Sami Convention. Journal on Ethnopolitics and Minority Issues in Europe, 15(1): 75–116. www.ecmi.de/fileadmin/downloads/publications/JEMIE/2016/Carstens.pdf

CCMSS. 2016. Una propuesta para enfrentar la sobre regulación que afecta al sector forestal. Nota Informativa número 48. Mexico: Red de Monitoreo de Políticas Públicas del CCMSS. www.ccmss.org.mx/wp-content/uploads/2016/12/Propuesta_para_enfrentar_sobre_regulacio%CC%81n_forestal_CCMSS_01_12_2016.pdf (Accessed on 10/05/2021).

CCMSS. 2020. En el sector forestal, metas ambiciosas y presupuesto insuficiente. Consejo Civil Mexicano para la Silvicultura Sostenible. www.ccmss.org.mx/en-el-sector-forestal-metas-ambiciosas-y-presupuesto-insuficiente/ (Accessed on 12/05/2021).

CEPF. 2011. Eastern Afromontane ecosystem profile summary. Arlington, USA: Critical Ecosystems Partnership Fund (CEPF). www.cepf.net/sites/default/files/cepf_eam_eng_r3.pdf

CEPLAN. 2011. *Plan Bicentenario: El Perú hacia el 2021*. Aprobado por el Acuerdo Nacional. Centro Nacional de Planeamiento Estratégico. Lima, Perú. 282 pp. www.ceplan.gob.pe/documentos_/plan-bicentenario-el-peru-hacia-el-2021/

Challenger, A. & Dirzo, R. 2009. Factores de cambio y estado de la biodiversidad. In Capital natural de México, vol. II: Estado de conservación y tendencias de cambio. pp 37–73. México: CONABIO. https://bioteca.biodiversidad.gob.mx/janium/Documentos/7404.pdf (Accessed on 12/05/2021).

Chapela, G. 2018. Avances y retrocesos en la integración productiva de las comunidades forestales de México. In: Las empresas sociales forestales en México. Claroscuros y aprendizajes. México: CCMSS. www.ccmss.org.mx/wp-content/uploads/2018/10/Empresas_Sociales_Forestales_CCMSS_20102018.pdf (Accessed on 12/05/2021)

Chazdon, R.L., Harvey, C.A., Komar, O., Griffith, D.M., Ferguson, B.G., Martınez-Ramos, M., Morales, H. *et al.* 2009. Beyond reserves: A research agenda for conserving

biodiversity in human-modified tropical landscapes. *Biotropica*, 41(2): 142–153. https://doi.org/10.1111/j.1744-7429.2008.00471.x

Chepstow-Lusty, A.J., Bennett, K.D., Fjeldså, J., Kendall, A., Galiano, W. & Herrera, A.T. 1998. Tracing 4,000 years of environmental history in the Cuzco area, Peru, from the pollen record. *Mountain Research and Development*, 18(2): 159–172.

Chua, L.S.L., Suhaida, M. & Aslina, B. 2012. *Spesies Dipterokarpa Terancam di Semenanjung Malaysia*. Kepong: Forest Research Institute Malaysia. 212 pp. www.mybis.gov.my/pb/19

Chua, L.S.L., Suhaida, M., Hamidah, M. & Saw, L.G. 2010. *Malaysia Plant Red List: Peninsular Malaysian Dipterocarpaceae*. Research Pamphlet No. 129. Kepong: Forest Research Institute Malaysia. www.mybis.gov.my/pb/15

CIFOR. 2020. Community forestry can work, but plans in the Democratic Republic of Congo show what´s missing. June 29. www2.cifor.org/forets/en/community-forestry-can-work-but-plans-in-the-democratic-republic-of-congo-show-whats-missing/

CONAM. 2001. *Perú: Estrategia Nacional sobre Diversidad Biológica*. Consejo Nacional del Ambiente. Lima, Perú. 140 pp. https://sinia.minam.gob.pe/documentos/peru-estrategia-nacional-diversidad-biologica

CONABIO. onlineA. Catálogos de especies. Mexico: CONABIO. www.biodiversidad.gob.mx/especies/CAT.html (Accessed on 10/05/2021).

CONABIO. onlineB. Capital Natural de México (segundo estudio de país). Mexico: CONABIO. www.biodiversidad.gob.mx/pais/capitalNatMex (Accessed on 10/05/2021).

CONABIO. 2011. La biodiversidad en Veracruz: Estudio de Estado. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Gobierno del Estado de Veracruz, Universidad Veracruzana, Instituto de Ecología, A.C. México: CONABIO. http://siaversedema.org.mx/wp-content/uploads/2018/04/publicacion/Biodiversidad%20Estudio%20Estado%20Vol%20II.pdf (Accessed on 12/05/2021).

CONABIO. 2016. Estrategia Nacional sobre Biodiversidad de México (ENBIOMEX) y Plan de Acción 2016–2030. www.cbd.int/doc/world/mx/mx-nbsap-v2-es.pdf (Accessed on 12/05/2021)

CONABIO. 2018. Estrategias estales de Biodiversidad. www.biodiversidad.gob.mx/media/1/region/eeb/files/EEB_ResumenEjecutivo_agosto_2018.pdf (Accessed on 13-05-2021).

CONAFOR. online. Innovación Forestal. www.conafor.gob.mx/innovacion_forestal/ (Accessed on 12/05/2021).

CONAFOR. 2013. Situación actual y perspectivas de las plantaciones forestales comerciales en México. https://framework-gb.cdn.gob.mx/files/conafor/Libro-Situacion%20Actual%20y%20Perspectivas_de_las_Plantacionaes_Forestales_Comerciales_en_Mexico.pdf (Accessed on 11/05/2021).

CONAFOR. 2014, Sistemas agroforestales maderables en México, CONAFOR, Jalisco, México. https://framework-gb.cdn.gob.mx/files/conafor/Estudio-Sistemas_Agroforestales_Maderables_en_Mexico.pdf (Accessed on 11/05/2021).

CONAFOR. 2017. Apoyos del Fondo Patrimonial de Biodiversidad, CONAFOR. www.gob.mx/conafor/acciones-y-programas/apoyos-del-fondo-patrimonial-de-biodiversidad (Accessed on 12/05/2021).

CONAFOR. 2018c. Informe de Resultados del Inventario Nacional Forestal y de Suelos, 2009–2014. Con base en la Carta de Uso de Suelo y Vegetación del INEGI, Serie VI-2014. Mexico: CONAFOR. https://snigf.cnf.gob.mx/resultados-2009-2014-resultados-que-recaba-los-principales-indicadores-forestales-generados-a-partir-del-analisis-estadistico-de-las-variables-levantadas-en-campo/ (Accessed on 12/05/2021)

CONAFOR. 2019. Dieciocho años fortaleciendo el sector forestal de México. www.gob.mx/conafor/es/articulos/18-anos-fortaleciendo-el-sector-forestal-de-mexico?idiom=es (Accessed on 10/05/2021)

CONAFOR. 2020a. El Sector Forestal Mexicano en Cifras 2019: Bosques para el Bienestar Social y Climático, Jalisco, México, CONAFOR. www.conafor.gob.mx:8080/documentos/docs/1/7749El%20Sector%20Forestal%20Mexicano%20en%20Cifras%202019.pdf (Accessed on 12/05/2021).

CONAFOR. 2020b. Noticias forestales, Jalisco, México, CONAFOR. www.gob.mx/conafor/documentos/noticias-del-sector-forestal-julio-de-2020?idiom=es (Accessed on 12/05/2021)

CONAFOR. 2020c. Nivel de referencia de emisiones forestales de México (2007–2016). Jalisco, México, CONAFOR. https://redd.unfccc.int/files/nref_2007-2016_mexico.pdf (Accessed on 12/09/2021)

CONAFOR. 2020d. Reglas de Operación 2021 de la CONAFOR Apoyos para el Desarrollo Forestal Sustentable. www.gob.mx/conafor/documentos/reglas-de-operacion-2021?idiom=es

CONAFOR. 2020e. Participación de la mujer en proyectos productivos forestales, casos de éxito, seminario. CONAFOR. www.monitoreoforestal.gob.mx/wp-content/uploads/2020/08/Participacio_n_de_la_mujer_en_proyectos_productivos_forestales._Casos_de_e_xito_.pdf (Accessed on 8/05/2021).

CONAFOR. 2020f. Premio Nacional al Mérito Forestal 2020. www.gob.mx/conafor/documentos/premio-nacional-al-merito-forestal-2020 (Accessed on 12/05/2021).

CONAFOR. 2021b. Mapas de Cobertura del Suelo al año base 2016 y Mapas de Cambios de Cobertura del Suelo del Sistema Satelital de Monitoreo Forestal. www.gob.mx/conafor/documentos/mapas-de-cobertura-del-suelo-al-ano-base-2016-y-mapas-de-cambios-de-cobertura-del-suelo-del-sistema-satelital-de-monitoreo-forestal; https://idefor.cnf.gob.mx/mviewer/samof (Accessed on 12/05/2021).

CONAFOR & CICC. 2017. Estrategia Nacional para la Reducción de Emisiones por Deforestación y Degradación (ENAREDD+), Mexico. www.enaredd.gob.mx/wp-content/uploads/2017/09/Estrategia-Nacional-REDD+-2017-2030.pdf (Accessed on 10/05/2021).

CONEVAL. 2019. Diez años de medición de pobreza multidimensional en México: avances y desafíos en política social medición de la pobreza serie 2008 2018. www.coneval.org.mx/Medicion/MP/Documents/Pobreza_18/Pobreza_2018_CONEVAL.pdf (Accessed on 12/05/2021).

Confor. 2020. *Biodiversity, forestry and wood: an analysis of the biodiversity benefits of modern forestry and wood production*. A Confor Special Report. 36 pp. www.confor.org.uk/media/247794/confor-biodiversity-forestry-report.pdf

Cortina, S. 2013. Magnitud y causas de la deforestación en los Altos de Chiapas ¿Hay lugar para la conservación de la biodiversidad? pp. 326–329. En: *La biodiversidad en Chiapas: Estudio de Estado*. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) y Gobierno del Estado de Chiapas, México. https://bioteca.biodiversidad.gob.mx/janium/Documentos/6852.pdf (Accessed on 12/05/2021)

Daly, E., Fenn, T. & Miller, J. 2015. *Evaluation of the compliance and quality of biodiversity duty reports 2015*. Social Research series. Scottish Government. 93 pp. www.gov.scot/publications/evaluation-compliance-quality-biodiversity-duty-reports-2015/pages/4/

D'Antonio, C. & Meyerson, L.A. 2002, Exotic plant species as problems and soluctions in ecological restoration: A synthesis. *Restoration Ecology,* 10(4): 703–713. https://doi.org/10.1046/j.1526-100X.2002.01051 (Accessed on 13/05/2021).

De Icaza, C. 2021. Environmental law and practice in Mexico: overview. https://uk.practicallaw.thomsonreuters.com/7-508-8956?transitionType=Default&contextData=(sc.Default)&firstPage=true (Accessed on 10/05/2021).

de Queiroz, J.S., Silva, F., Ipenza, C., Hernick, C., Batallanos, L., Griswold, D. & Rogers, A.E. 2014. *Peru tropical forest and biodiversity assessment*. US Foreign Assistance Act, Section 118/119 Report August. Washington DC: USAID. 142 pp. https://usaidgems.org/Documents/FAA&Regs/FAA118119LAC/Peru%20FAA%20118%20119%20FB%20Assessment%20August%202014.pdf

de Wasseige, C., Devers, D., de Marcken, R, Eba'a Atyi, R., Nasi, R. & Mayaux, P., eds. 2009. *Les Forêts du Bassin du Congo: Etat des Forêts 2008*. Luxembourg, Office des publications de l'Union européenne. 426 pp. ISBN: 978-92-79-132 11-7. www.observatire-comifac.net

de Wasseige, C., Flynn, J., Louppe, D., Hiol Hiol F. & Mayaux, P., eds. 2014. *The Forests of the Congo Basin: State of the Forest 2013*. Weyrich. Belgium. 328 pp. https://agritrop.cirad.fr/574741/1/document_574741.pdf

de Wasseige, C., Tadoum, M., Eba'a Atyi, R. & Doumenge, C., eds. 2015. *Les forêts du Bassin du Congo: Forêts et changements climatiques*. Weyrich. Belgique. 128 pp. https://agritrop.cirad.fr/578900/1/Forets%20du%20bassin%20du%20congo.pdf

Debella, H.J. 2019. "Command and control": 75 Years of quasi wildlife policy analysis of Ethiopia. *Journal of International Wildlife Law & Policy*, 22(1): 33–54. https://doi.org/10.1080/13880292.2019.1611217

Debroux, L., Hart, T., Kaimowitz, D., Karsenty, A. & Topa, G., eds. 2007. *Forests in post-conflict Democratic Republic of Congo: Analysis of a Priority Agenda*. A joint report by teams of the World Bank, Center for International Forestry Research (CIFOR), Centre International de Recherche Agronomique pour le Développement (CIRAD), African Wildlife Foundation (AWF), Conseil National des ONG de Développement du Congo (CNONGD), Conservation International (CI), Groupe de Travail Forêts (GTF), Ligue Nationale des Pygmées du Congo (LINAPYCO), Netherlands

Development Organisation (SNV), Réseau des Partenaires pour l'Environnement au Congo (REPEC), Wildlife Conservation Society (WCS), Woods Hole Research Center (WHRC), World Agroforestry Centre (ICRAF) and World Wide Fund for Nature (WWF). xxii, 82p. ISBN 979-24-4665-www.cifor.org/publications/pdf_files/Books/BCIFOR0701.pdf

Dedefo, K., Derero, A., Tesfaye, Y. & Muriuki, J. 2017. Tree nursery and seed procurement characteristics influence on seedling quality in Oromia, Ethiopia. *Forests, Trees and Livelihoods*, 26(2): 96–110. https://doi.org/10.1080/14728028.2016.1221365

Del Castillo, A. 2020. How Mexican communities are helping to save a fir forest. Mongabay Latam. https://news.mongabay.com/2020/07/how-mexican-communities-are-helping-to-save-a-fir-forest/ (Accessed on 12/05/2021).

Derero, A. 2011. Toward a tree seed system that guarantees quality and satisfies demand in Ethiopia. In: A. Derero, W. Fantu & Z. Eshetu, eds. *Trends in tree seed systems in Ethiopia*. Addis Ababa: EIAR.

Derero, A. 2012. Evaluation of tree seeds and seedling system in Ethiopia with focus in Wolaita and Arsi. Addis Ababa, Ethiopia. Unpublished report. 50 pp.

Dhedya Lonu, M.B. 2018. Industrial logging, legal pluralism and land formalization policy in the DRC. Case of the Alibuku forest concession.

Di Marco, M., Chapman, S., Althor, G., Kearney, S., Besancon, C., Butt, N., Maina, J.M. *et al.* 2017. Changing trends and persisting biases in three decades of conservation science. *Global Ecology and Conservation*, 10: 32–42. www.sciencedirect.com/science/article/pii/S2351989417300148

Di Minin, E.I. & Moilanen, A. 2014. Improving the surrogacy effectiveness of charismatic megafauna with well-surveyed taxonomic groups and habitat types. *Journal of Applied Ecology*, 51(2): 281–288. www.jstor.org/stable/24032359

Dinerstein, E., Olson, D., Joshi, A., Vynne, C., Burgess, N.D., Wikramanayake, E., Hahn, N. *et al.* 2017. An ecoregion-based approach to protecting half the terrestrial realm. *BioScience*, 67(6): 534–545. https://doi.org/10.1093/biosci/bix014

DOF. 2015. Norma Mexicana para la certificación del uso sustentable de bosques. www.dof.gob.mx/nota_detalle.php?codigo=5411873&fecha=16/10/2015 (Accessed on 12/05/2021).

DOF. 2019a. Plan Nacional de desarrollo 2019–2024. www.dof.gob.mx/nota_detalle.php?codigo=5565599&fecha=12/07/2019 (Accessed on 10/05/2021).

DOF. 2019b. Acuerdo por el que se emiten los Lineamientos de Operación del Programa Sembrando Vida 24/01/2019. Mexico: DOF. www.gob.mx/cms/uploads/attachment/file/435247/Lineamientos_de_Operaci_n_del_Programa_Sembrando_Vida.pdf (Accessed on 12/05/2021)

DOF. 2020. Reglamento de la ley de desarrollo forestal sustentable. Mexico City, Mexico: SEGOB. www.dof.gob.mx/nota_detalle.php?codigo=5607136&fecha=09/12/2020 (Accessed on 12/05/2021)

DOF. 2021a. Ley General del Equilibrio Ecológico y Protección al Ambiente (LGEEPA). Diario Oficial de la Federación, México. www.diputados.gob.mx/LeyesBiblio/pdf/148_180121.pdf (Accessed on 12/05/2021).

DOF. 2021b. Decreto por el que se reforman diversas disposiciones de la Ley General de

Desarrollo Forestal Sustentable. Mexico: DOF. www.dof.gob.mx/nota_detalle.php?codigo=5616767&fecha=26/04/2021 (Accessed on 10/05/2021).

DOF. 2021c. Ley general de Desarrollo Forestal Sustentable. www.diputados.gob.mx/LeyesBiblio/pdf/LGDFS_260421.pdf (Accessed on 12/05/2021)

Doumenge, C., Palla, F., Scholte, P., Hiol Hiol, F. & Larzillière, A. eds. 2015. *Aires protégées d'Afrique centrale: État 2015*. OFAC, Kinshasa, République Démocratique du Congo et Yaoundé, Cameroun 256 pp. https://pfbc-cbfp.org/files/docs/Bassin%20du%20Congo/EdF/EdAP-2015_Sao_Tome.pdf

DWNP. 2008. *National Tiger Action Plan for Malaysia 2008–2020*. Department of Wildlife and National Parks of Malaysia. www.catsg.org/fileadmin/filesharing/3.Conservation_Center/3.4._Strategies___Action_Plans/Tiger/DWNP_2008_National_Tiger_Action_Plan_Malaysia_2008-2020.pdf

DWNP. 2013. National Elephant Conservation Action Plan: Blueprint to Save Malaysian Elephants. Department of Wildlife and National Parks Peninsular Malaysia, Kuala Lumpur, Malaysia.

Ecosphere+. 2019. *Supporting local communities through Quality of Life Plans in Cordillera Azul*. https://ecosphere.plus/2019/12/19/supporting-local-communities-through-quality-of-life-plans-in-cordillera-azul/

Ejido Verde. 2021. El Ejido Verde (online). https://ejidoverde.com/

Environment Climate Change and Land Reform Committee. 2017. Report on deer management in Scotland: Report to the Scottish Government from Scottish Natural Heritage 2016. https://digitalpublications.parliament.scot/Committees/Report/ECCLR/2017/4/3/Report-on-Deer-Management-in-Scotland--Report-to-the-Scottish-Government-from-Scottish-Natural-Heritage-2016

Eurostat. 2021. Forest, forestry and logging, in Forestry explained. European Commission. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Forests,_forestry_and_logging

Evans, M. 2018. Ethiopia's new forestry law: A win for landscapes and livelihoods? Legislation advances community rights in forest management. CIFOR. https://forestsnews.cifor.org/57465/ethiopias-new-forestry-law-a-win-for-landscapes-and-livelihoods?fnl. Retrieved Apr 2021

FAO. 1986. Ethiopian Highlands Reclamation Study. Final Report. 2 Volumes. www.fao.org/3/ar863e/ar863e.pdf

FAO. 2014. State of the World's Forests. Rome: Food and Agriculture Organization of the United Nations. www.fao.org/3/a-i3710e.pdf

FAO. 2020a. Global Forest Resources Assessment 2020. Report Ethiopia. Rome, Italy: FAO. www.fao.org/3/ca9991en/ca9991en.pdf

FAO. 2020b. Global Forest Resources Assessment 2020: Main report. Rome, Italy: FAO. https://doi.org/10.4060/ca9825en

FAO & FILAC. 2021. Forest Governance by Indigenous and Tribal People. An Opportunity for Climate Action in Latin America and the Caribbean. Santiago. www.fao.org/3/cb2953en/cb2953en.pdf

FAO & UNEP. 2020. *The State of the World's Forests 2020. Forests, biodiversity and people*. Rome. www.fao.org/3/ca8642en/ca8642en.pdf

FDRE. 1994. Forestry Conservation, Development and Utilization Proclamation No. 94/1994. Proclamation No. 94/1994, pp. 372–379. Federal Democratic Republic of Ethiopia (FDRE). www.fao.org/faolex/results/details/en/c/LEX-FAOC008954/

FDRE. 1995. Environmental Protection Authority Establishment Proclamation Proclamation No. 9/1995, pp. 70–73. Federal Democratic Rebublic of Ethiopia (FDRE).

FDRE. 1997. Environmental Policy. Federal Democratic Republic of Ethiopia (FDRE). pp. 1–27.

FDRE. 2006. Access to Genetic Resources and Community Knowledge, and Community Rights Proclamation. Proclamation No. 482/2006: 3353–3373. Federal Democratic Republic of Ethiopia (FDRE). https://ictpolicyafrica.org/en/document/8geczijbchp

FDRE. 2007. Development, Conservation and Utilization of Wildlife. Proclamation No. 541/2007: 3734–3745. Federal Democratic Republic of Ethiopia (FDRE). http://extwprlegs1.fao.org/docs/pdf/eth95249.pdf

FDRE. 2011. Ethiopia's Climate-Resilient Green Economy: Green economy strategy. Federal Democratic Republic of Ethiopia (FDRE). www.undp.org/content/dam/ethiopia/docs/Ethiopia%20CRGE.pdf

FDRE. 2016a. Ethiopia's National Biodiversity Strategy and Action Plan 2015–2020. Federal Democratic Republic of Ethiopia (FDRE). www.cbd.int/doc/world/et/et-nbsap-oth-en.pdf

FDRE. 2016b. Growth and Transformation Plan II (GTP II) (2015/16–2019/20). Federal Democratic Republic of Ethiopia (FDRE). https://ethiopia.un.org/en/download/2447/15231

FDRE. 2016c. Intended Nationally Determined Contribution (INDC) of the Federal Democratic Republic of Ethiopia. Federal Democratic Republic of Ethiopia (FDRE). www4.unfccc.int/ndcregistry/PublishedDocuments/Ethiopia%20First/INDC-Ethiopia-100615.pdf

FDRE. 2016d. Land Degradation Neutrality National Report. Federal Democratic Republic of Ethiopia (FDRE) and UNCCD Secretariat. https://knowledge.unccd.int/sites/default/files/inline-files/ethiopia-ldn-country-report-final.pdf

FDRE. 2017a. Forest Sector Review. Focus on commercial forestry and industrialization. Federal Democratic Republic of Ethiopia (FDRE). www.forestcarbonpartnership.org/system/files/documents/Ethiopia%20FSR%20final.pdf

FDRE. 2017b. National Forest Sector Development Program, Ethiopia. Volume III Synthesis Report. Federal Democratic Republic of Ethiopia (FDRE). www.et.undp.org/content/dam/ethiopia/docs/2018/National%20Forest%20Sector%20Development%20Programme%20Volume%20III%20Synthesis%20report.pdf

FDRE. 2018. Forest Development, Conservation and Utilization Proclamation. Proclamation No. 1065/2018: pp. 10068–10090. Federal Democratic Republic of Ethiopia (FDRE). http://extwprlegs1.fao.org/docs/pdf/eth182203.pdf

Fernández Vázquez, E. 2015. Las comunidades forestales, la certificación y las cadenas de suministro. Mexico City, Mexico: CCMSS. www.ccmss.org.mx/wp-content/uploads/2015/11/FSC-Comunitario.pdf (Accessed on 13/05/2021).

Finér, L., Čiuldienė, D., Lībieté, Z., Lode, E., Nieminen, M., Pierzgalski, E., Ring, E., Strand, L. & Sikström, U. 2018. WAMBAF – Good Practices for Ditch Network

Maintenance to Protect Water Quality in the Baltic Sea Region. http://urn.fi/URN:ISBN:978-952-326-576-9

Flores, A., Muñoz Gutiérrez, L., Velasco García, M.V. & Zamora Morales, B.P. 2018. Desarrollo y perspectivas de investigación en Plantaciones y Sistemas Agroforestales. In: M.C. Zamora-Martinez, F.T.A. Garcia Camusano & C. Mendez Espinosa, eds. *60 años de la investigación forestal en Coyoacán*. Mexico City, Mexico: Cenid-Comef, INIFAP. www.researchgate.net/publication/330211496_Desarrollo_y_perspectivas_de_investigacion_en_Plantaciones_y_Sistemas_Agroforestales (Accessed on 12/05/2021).

FMCN, CONAFOR, USAID & USFS. 2018. Manual para muestrear la vegetación en bosques, selvas, zonas áridas y semiáridas. In: BIOCOMUNI-Monitoreo Comunitario de la Biodiversidad, una guía para núcleos agrarios. Mexico City, Mexico: CONAFOR-FMCN. http://biocomuni.mx/descargas/ (Accessed on 12/05/2021).

Forestry Agency. 1993. Corporate forest (Houjin no Shinrin Seido) (In Japanese). www.rinya.maff.go.jp/j/kokuyu_rinya/kokumin_mori/katuyo/kokumin_sanka/hojin_mori/

Forestry Agency. 2020. Outlines of Forest Certification. (In Japanese). www.rinya.maff.go.jp/j/keikaku/ninshou/con_3.html

Forestry Agency. 2022. Forestry White Paper 2021 (In Japanese). www.rinya.maff.go.jp/j/kikaku/hakusyo/r3hakusyo/attach/pdf/zenbun-34.pdf

Forest Policy Group. 2011. Forest Ownership in Scotland. *Woods for People*. Briefing paper 3 of 7. September 2011. 2 pp. www.forestpolicygroup.org/wp-content/uploads/2014/08/FPG-briefing-3-Forest-Ownership.pdf.

Forestry and Land Scotland. 2019. Forestry and Land Scotland Corporate Plan 2019–2022. https://forestryandland.gov.scot/images/corporate/corporate-plan/FLS-Corporate-Plan-2019-2022-v2.pdf.

Forestry and Land Scotland. 2020. FLS Biodiversity Duty Report 2018–2020: Report to Scottish Government. https://forestry.gov.scot/publications/forests-and-the-environment/biodiversity/986-scottish-forestry-biodiversity-duty-report-2018-2020

Forestry and Land Scotland. 2022. Forestry and Land Scotland Corporate Plan 2019–2025. https://forestryandland.gov.scot/what-we-do/who-we-are/corporate-information/corporate-plan

Forestry Commission. 2017. *The UK Forestry Standard: the governments' approach to sustainable forestry*. Forestry Commission, Edinburgh. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687147/The_UK_Forestry_Standard.pdf

Fregoso Rojas, P.A. 2019. A Mexican Experience with the Sustainable Use of Biodiversity: Transformative Insights for A Global Challenge. *Social Innovations Journal* online. https://socialinnovationsjournal.org/editions/issue-55-1/75-disruptive-innovations/3022-a-mexican-experience-with-the-sustainable-use-of-biodiversity-transformative-insights-for-a-global-challenge (Accessed on 13/05/2021).

Friis, I., Demissew, S. & Breugel, P.V. 2010. *Atlas of the Potential Vegetation of Ethiopia*. Det Kongelige Danske Videnskabernes Selskab.

Gallina, S. & Escobedo-Morales, L.A. 2009. Análisis sobre las Unidades de Manejo (UMAs) de ciervo rojo (Cervus elaphus Linnaeus, 1758) y wapiti (Cervus canadensis

(Erxleben, 1777) en México: problemática para la conservación de los ungulados nativos. *Tropical Conservation Science*, 2(2): 251–265. https://journals.sagepub.com/doi/pdf/10.1177/194008290900200211

Gardner, T.A., Barlow, J., Chazdon, R., Ewers, R.M., Harvey, C.A., Peres, C.A. & Sodhi, N.S. 2009. Prospects for tropical forest biodiversity in a human-modified world. *Ecology Letters*, 12(6): 561–582. https://doi.org/10.1111/j.1461-0248.2009.01294.x

Gaviria, A. & Sabogal, C. eds. 2013. *Sistematización de seis experiencias de manejo forestal comunitario en la Amazonía Peruana*. Proyecto Inventario Nacional Forestal y Manejo Forestal Sostenible del Perú ante el Cambio Climático FAO-Finlandia/MINAG-MINAM. Lima, Perú. 88 pp. http://pronaturaleza.org/wp-content/uploads/2013/Otras-Publicaciones/PDF-01.pdf

GCF. 2021. Projects & Programmes. FP136. Resilient Landscapes and Livelihoods Project. Green Climate Fund (GCF). www.greenclimate.fund/project/fp136

Global Forest Watch. 2019. Coatis, Conservation and Cattle Smuggling: The Forests of Petén-Veracruz. Global Forest Watch (online). https://blog.globalforestwatch.org/data-and-research/coatis-conservation-cattle-forests-peten-veracruz/ (Accessed on 12/05/2021)

Gobeze, T., Bekele, M., Lemenih, M. & Kassa, H. 2009. Participatory forest management and its impacts on livelihoods and forest status: the case of Bonga forest in Ethiopia. *International Forestry Review*, 11(3): 346–358.

Gómez Durán, T. 2019. ¿Cómo conservar los bosques? La respuesta está en el manejo forestal comunitario. *Mongabay Latam* online. https://es.mongabay.com/2019/11/mexico-manejo-forestal-comunitario-entrevista/ (Accessed on 13/05/2021).

Guariguata, M.R., Arce, J., Ammour, T. & Capella, J.L. 2017. *Las plantaciones forestales en Perú: Reflexiones, estatus actual y perspectivas a futuro*. Documento Ocasional 169. Bogor, Indonesia: CIFOR. 40 pp. https://repositorio.spda.org.pe/bitstream/20.500.12823/77/1/Las_plantaciones_forestales_2017.pdf

Hamidah, M., Hasmadi, I.M., Chua, L.S.L., Lau, K.H., Faridah-Hanum, I., Yong, W.S.Y. & Pakhriazad, H.Z. 2020. Towards identification of important plant areas (IPA) for Peninsular Malaysia. Methodology and future directions. *Heliyon*, 6(7): e04370.

Hayhow, D.B., Eaton, M.A., Stanbury, A.J., Burns, F., Kirby, W.B., Bailey, N., Beckmann, B. *et al.* 2019. *State of nature 2019*. The State of Nature partnership. https://nora.nerc.ac.uk/id/eprint/525772/1/N525772CR.pdf

Hein, L. & Gatzweiler, F. 2006. The economic value of coffee (Coffea arabica) genetic resources. *Ecological Economics*, 60(1): 176–185. https://doi.org/10.1016/j.ecolecon.2005.11.022

Hernández, M.A. 2020. Radiografía del manejo forestal comunitario en México: un modelo bajo presión. *Mongabay Latam* online. https://es.mongabay.com/2020/09/radiografia-del-manejo-forestal-comunitario-mexico/ (Accessed on 7/05/2021).

Höhl, M., Ahimbisibwe, V., Stanturf, J.A., Elsasser, P., Kleine, M. & Bolte, A. 2020. Forest landscape restoration – what generates failure and success? *Forests*, 11(9): 938. https://doi.org/10.3390/f11090938

Humphrey, J.W. & Bailey, S. 2012. *Managing deadwood in forests and woodlands*. Forestry Commission Practice Guide. Forestry Commission, Edinburgh. 24 pp.

Humphrey, J., Watts, K., Fuentes-Montemayor, E., Macgregor, N. & Park, K.J. 2013. *The evidence base for ecological networks: lessons from studies of woodland fragmentation and creation*. Forest Research. The Research Agency of the Forestry Commission, Roslin and University of Stirling. 52 pp. www.wren-project.com/uploads/9/2/4/0/92403122/humphrey_et_al.2013_fr_report.pdf

Hurni, H. 1988. Degradation and conservation of the resources in the Ethiopian highlands. *Mountain Research and Development*, pp.123–130.

Husen, A., Mishra, V.K., Semwal, K. & Kumar, D. 2012. Biodiversity status in Ethiopia and challenges. *Environmental Pollution and Biodiversity*, 1: 31–79. https://doi.org/10.13140/RG.2.1.1788.9121

Hyvärinen, E., Juslén, A., Kemppainen, E., Uddström, A. & Liukko, U.-M. 2019. The 2019 Red List of Finnish Species (in Finnish). Ympäristöministeriö & Suomen ympäristökeskus. www.environment.fi/redlist www.environment.fi/en-US/Nature/Species/Threatened_species/The_2019_Red_List_of_Finnish_species/Summary_of_the_Assessment_of_Endangered_Species_2019

IBC. 2012. The state of the world's forest genetic resources. Country report: Ethiopia. Addis Ababa: Institute of Biodiversity Conservation (IBC) www.fao.org/3/i3825e/i3825e23.pdf

ICRAF. 2017. Provision of Adequate Tree Seed Portfolios (PATSPO) to enhance Productivity and Resilience of Forest Landscape Restoration in Ethiopia. Project document. PASTPO, 2017–2020. Nairobi, Kenya: World Agroforestry Centre (ICRAF), Nairobi, Kenya. www.worldagroforestry.org/project/provision-adequate-tree-seed-portfolio-ethiopia

ICRAF. 2021. Provision of Adequate Tree Seed Portfolios (PATSPO) 2017–2021. Project status (early 2021) in the fourth year of implementation. Nairobi, Kenya: World Agroforestry Centre (ICRAF). www.worldagroforestry.org/sites/agroforestry/files/2021-05/PATSPO_Brief_2021.pdf

Igarashi, T. & Kiyono, Y. 2008. The potential of hinoki (Chamae-cyparis obtusa [Sieb. et Zucc.] Endlicher) plantation forests for the restoration of the original plant community in Japan. *Forest Ecology and Management,* 255(1): 183–192.

Ihalainen, A., Mäki-Simola, E., Peltola, A., Sauvula-Seppälä, T., Torvelainen, J., Uotila, E., Vaahtera, E. & Ylitalo, E. 2019. Suomen Metsätilastot – Finnish forest statistics 2019. Luonnonvarakeskus, Helsinki. https://stat.luke.fi/sites/default/files/suomen_metsatilastot_2019_verkko2.pdf

IMF. 2013. *Democratic Republic of the Congo: Growth and poverty reduction strategy paper – Second generation* (GPRSP2 2011–2015). IMF Country Report No. 13/226. July 2013. 103 pp. www.imf.org/external/pubs/ft/scr/2013/cr13226.pdf

INEGI. 2015. Conjunto de datos vectoriales de Uso de Suelo y Vegetación, Escala 1:250 000 Serie V. Instituto Nacional de Estadística y Geografía. México: INEGI. www.inegi.org.mx/contenidos/temas/mapas/usosuelo/metadatos/guia_interusosuelov.pdf (Accessed on 12/05/2021).

INIFAP. online. Innovaciones para el campo. Mexico: INIFAP. https://vun.inifap.gob.mx/portalweb/_Innovacionesparaelcampo (Accessed on 9/05/12).

Initiative 20x20. 2021a. Restoring 1 million hectares of degraded land in Mexico. https://initiative20x20.org/restoration-projects/restoring-1-million-hectares-degraded-land-mexico. Accessed on 12/05/2021

Initiative 20x20. 2021b. Nurturing trees in tough conditions on Mexico's Lake Texcoco. https://initiative20x20.org/restoration-projects/nurturing-trees-tough-conditions-mexicos-lake-texcoco. Accessed on 12/05/2021

Initiative 20x20. 2021c. Planting mesquite trees in Mexico to supply the barbecue market. https://initiatzive20x20.org/restoration-projects/planting-mesquite-trees-mexico-supply-barbecue-market. Accessed on 12/05/2021

INPI. 2017. Indicadores socioeconómicos de los pueblos indígenas de México, 2015. Instituto Nacional de los Pueblos Indígenas. www.gob.mx/inpi/articulos/indicadores-socioeconomicos-de-los-pueblos-indigenas-de-mexico-2015-116128 (Accessed on 12/05/2021)

Isagi, Y. & Torii, A. 1997. Range expansion and its mechanisms in a naturalized bamboo species, *Phyllostachys pubescens*, in Japan. *Journal of Sustainable Forestry*, 6(1–2): 127–141, DOI: 10.1300/J091v06n01_08

Ishizaki, R. & Matsuda, S. 2021. Message for solidarity: A Japanese perspective on the payment for forest ecosystem services developed over centuries of history. *Sustainability,* 13: 12846. https://doi.org/10.3390/su132212846

IUCN. 2021. Bonn Challenge: current pledges. International Union for Conservation of Nature (IUCN). www.bonnchallenge.org/pledges. Retrieved 20 May 2021.

Iwamoto, J., 2002. The development of Japanese forestry. In: Y. Iwai, ed. *Forestry and the forest industry in Japan*, pp. 3–9. Vancouver/Toronto: UBC Press. www.ubcpress.ca/asset/12526/1/9780774808828.pdf

Jalonen, R., Valette, M., Boshier, D., Duminil, J. & Thomas, E. 2018. Forest and landscape restoration severely constrained by a lack of attention to the quantity and quality of tree seed: Insights from a global survey. *Conservation Letters*, 11(4): 12424. https://doi.org/10.1111/conl.12424

Jardel Peláez, E.J. 2015. Criterios para la conservación de la biodiversidad en los programas de manejo forestal. Mexico: CONAFOR. www.conafor.gob.mx:8080/documentos/docs/49/6529Criterios%20para%20la%20conservaci%C3%B3n%20de%20biodiversidad%20en%20los%20programas%20de%20manejo%20forestal.pdf (Accessed on 12/05/2021).

JBO3 Science Committee. 2021. SPM Japan Biodiversity Outlook 3 (In Japanese). www.env.go.jp/press/files/jp/115844.pdf

J-Credit Secretary. 2013. The J-Credit Scheme. https://japancredit.go.jp/english/

JNCC & Defra (on behalf of the Four Countries' Biodiversity Group). 2012. UK Post-2010 Biodiversity Framework. July 2012. Available from: http://jncc.defra.gov.uk/page-6189.

Kadoya, T. & Washitani, I. 2011. The Satoyama Index: A biodiversity indicator for agricultural landscapes. *Agriculture, Ecosystems and Environment*, 140(1–2): 20–26.

Kanagawa Prefecture. 2021. Protecting and managing deer population (in Japanese). www.pref.kanagawa.jp/docs/f4y/03shinrin/sika.html

Kamal, S.F. 2020. Rationalising the role of Orang Asli in co-management of the Royal Belum State Park, Malaysia. *Journal of Tropical Forest Science*, 32(4): 361–368. https://web.archive.org/web/20201104043030id_/https://info.frim.gov.my/infocenter_applications/jtfsonline/jtfs/v32n4/361-368.pdf

Kamaruzaman, M.P.B. & Wan Ahmad, W.M.S. 2003. Forest harvesting practices towards achieving sustainable forest management in Peninsular Malaysia. www.rinya.maff.go.jp/code-h2003/PART_4/Mohd_Paiz_(Malaysia).pdf

KATS. 2019. A Master List of Protected Areas in Malaysia: A Tool for National Biodiversity Conservation Management and Planning. Putrajaya: Ministry of Water, Land and Natural Resources, Malaysia.

Kaukonen, M., Eskola, T., Herukka, I., Karppinen, H., Karvonen, L., Korhonen, I., Kuokkanen P. & Ervola, A., eds. 2022: Metsähallitus Metsätalous Oy:n ympäristöopas. Metsähallitus' Environmental Guide (translated). www.e-julkaisu.fi/metsahallitus/yopas/pdf/MH_ymparistoopas.pdf

Keeley, J. & Scoones, I. 2000. Knowledge, power and politics: the environmental policy-making process in Ethiopia. *Journal of Modern African Studies,* 38(1): 89–120.

Kerr, G. 1999. The use of silvicultural systems to enhance the biological diversity of plantation forests in Britain. *Forestry*, 72: 191–205.

Kindt, R., Abiyu, A., Borchardt, P., Dawson, I., Demissew, S., Graudal, L., Jamnadass, R., Lillesø, J.-P., Moestrup, S., Pedercini, F., Wieringa, J., & Wubalem, T. 2021. A climate change atlas for Africa of tree species prioritized for forest landscape restoration in Ethiopia. https://atlas.worldagroforestry.org/

Klinga, P., Mikoláš, M., Smolko, P., Tejkal, M., Höglund, J. & Paule, L. 2019. Considering landscape connectivity and gene flow in the Anthropocene using complementary landscape genetics and habitat modelling approaches. *Landscape Ecology*, 34(3): 521–536. https://doi.org/10.1007/s10980-019-00789-9

Kohsaka, R. & Uchiyama, Y. 2022. Status and trends in forest environment transfer tax and information interface between prefectures and municipalities: Multi-level governance of forest management in 47 Japanese prefectures. *Sustainability*, 14, 1791. https://mdpi-res.com/d_attachment/sustainability/sustainability-14-01791/article_deploy/sustainability-14-01791-v2.pdf

Kontula, T. & Raunio, A. eds. 2018. Suomen luontotyyppien uhanalaisuus 2018. Luontotyyppien punainen kirja – Osa 1: Tulokset ja arvioinnin perusteet. Suomen ympäristökeskus ja ympäristöministeriö, Suomen ympäristö 5/2018. Assessment of threatened habitats types in Finland 2018. Red book of habitat types – Part 1: Results and basics for assessment. Finnish Environment Institute and Ministry of the Environment. 5/2018 (Translated). https://helda.helsinki.fi/handle/10138/308426

Korhonen, K. & Stahl, G. 2020. Criterion 1: Maintenance and Appropriate Enhancement of Forest Resources and their Contribution to Global Carbon Cycles. In: R. Raši, ed. *FOREST EUROPE: State of Europe's Forests 2020*. Ministerial Conference on the Protection of Forests in Europe – FOREST EUROPE Liaison Unit Bratislava: 30–44. https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf

Koskela, T., Anttila, S., Simkin, J., Aapala, K. & Syrjänen, K., eds. 2020. METSO-tilannekatsaus 2019. Etelä-Suomen metsien monimuotoisuuden toimintaohjelma 2008–2025. Luonnonvara- ja

biotalouden tutkimus 36/2020. https://jukuri.luke.fi/handle/10024/545957

Kourí, E. 2015. La invención del ejido (online). Mexico: Nexos. www.nexos.com.mx/?p=23778 (Accessed on 12/05/2021).

Kubota, V.R., Yoneda, T., Ugawa, S., Okuda, T. & Wan-Rasidah, K. 2018. Effects of selective management system on biomass structure and forest sustainability: A case study of a tropical rainforest in Peninsula Malaysia. *Journal of Tropical Forest Science*, 30(2): 259–268. https://jtfs.frim.gov.my/jtfs/article/download/340/248

Kyowa Kirin Co., Ltd. 2021. Annual Report 2021. https://ir.kyowakirin.com/en/library/annual/main/01/teaserItems1/0/linkList/0/link/ar2020_en.pdf#page=32&_ga=2.78551319.2036556444.1657291172-1537415317.1657291172

Land Reform Review Group. 2014. *The Land of Scotland and the Common Good*. Scottish Government. 262 pp. www.gov.scot/binaries/content/documents/govscot/publications/progress-report/2014/05/land-reform-review-group-final-report-land-scotland-common-good/documents/00451087-pdf/00451087-pdf/govscot%3Adocument/00451087.pdf

Law, Y-H. 2021. Deforestation project in Pahang exacerbates Orang Asli land rights struggle. *Macaranga*, June 25 2021. www.macaranga.org/yp-olio-pahang-orang-asli-land-rights-struggle/

Lawrence, A. & Ambrose-Oji, B. 2015. Beauty, friends, power, money: Navigating the impacts of community woodlands. *The Geographical Journal*, 181(3): 268–279. www.jstor.org/stable/43868655

Lazarus, B.A., Che-Amat, A., Abdul Halim Shah, M.M., Hamdan, A., Abu Hassim, H., Mustaffa Kamal, F., Tengku Azizan, T.R.P., Mohd Noor, M.H., Mohamed Mustapha, N. & Ahmad, H. 2021. Impact of natural salt lick on the home range of Panthera tigris at the Royal Belum Rainforest, Malaysia. *Scientific Reports*, 11(1). 1–8. www.nature.com/articles/s41598-021-89980-0.pdf

Lemelin, M. 2020. Indigenous People´s Day: Planning for the Future. Rainforest Trust. October 12 2020. www.rainforesttrust.org/our-impact/rainforest-news/indigenous-peoples-day-planning-for-the-future/

Levy-Tacher, S.I., Ramírez-Marcial, N., Navarrete-Gutiérrez, D.A. & Rodríguez-Sánchez, P.V. 2019. Are Mayan community forest reserves effective in fulfilling people's needs and preserving tree species? *Journal of Environmental Management*, 245: 16–27. https://p300.zlibcdn.com/dtoken/6048bd66eae5ceaa317e08b5ccd83303

Lyytimäki, J. 2015. Ecosystem disservices: Embrace the catchword. *Ecosystem Services,* 12: 136. https://doi.org/10.1016/j.ecoser.2014.11.008.

Mahmud, A.R. 2021. The need for improvement on environmental law in Malaysia. Proceeding – 23rd Kuala Lumpur International Business, Economics and Law Conference. 28 March 2021, Online Conference.

Malaysian Rubber Board. (sd). Rubber Trees – Green and Sustainable. www.lgm.gov.my/GreenMaterial/RubberTreesGreenSustainable.pdf. Downloaded on 15 April 2021

Martínez-Garza, C., Méndez-Toribio, M., Ceccon, E. & Guariguata, M.R. 2021. Ecosystem restoration in Mexico: insights on the project planning phase. *Botanical Sciences*, 99(2): 242–256. https://doi.org/10.17129/botsci.2695

Masés-García, C.A., Briones-Salas, M. & Sosa-Escalante, J.E. 2016. Análisis del manejo y aprovechamiento legal de los mamíferos silvestres de Oaxaca, México.

Revista Mexicana de Biodiversidad, 87(2): 497–507. www.scielo.org.mx/pdf/rmbiodiv/v87n2/1870-3453-rmbiodiv-87-02-00497.pdf

McMorran, R. 2016. Socio-economic and environmental outcomes from different landownership models in rural Scotland. In: S. Skerratt, J. Atterton, D. McCracken, R. McMorran & S. Thomson, eds. *Rural Scotland in Focus*. Scotland's Rural College. https://pure.sruc.ac.uk/en/publications/rural-scotland-in-focus-2016

McMorran, R. & Scott, A. 2013. Community landownership: rediscovering the road to sustainability. In: J. Glass, M.F. Price, C.R. Warren & A. Scott, eds. *Lairds, land and sustainability – Scottish perspectives on upland management*. Edinburgh University Press. 224 pp.

McMorran, R., Glass, J., Atterton, J., Jones, S., Perez Certucha, E., McKee, A.J., Combe, M., & Xu, T. 2020. Review of International Experience of Community, Communal and Municipal Ownership of Land. Scottish Land Commission. https://landcommission.gov.scot/downloads/5e8c359e459f3_A%20International%20Community%20Ownership %20Review%20Final%20Report.pdf (Accessed on 12/05/2021).

MECNEF. 2003. Plan National Forêt et Conservation de la Nature, Draft Annex 2: Agenda prioritaire – Moyen terme.

MEFCC. 2018. National Potential and Priority Maps for Tree-Based Landscape Restoration in Ethiopia (version 0.0): Technical Report. Addis Ababa: MEFCC. https://assets.forest-atlas.org/eth/documentation/MEFCC-Ethiopia-National-Landscape-Restoration_high-res.pdf

Mekonnen, A. & Bluffstone, R.A. 2014. Forest tenure reform in Ethiopia. In: R. Bluffstone & E.J. Robinson, eds. *Forest tenure reform in Asia and Africa: Local control for improved livelihoods, forest management, and carbon sequestration*. Routledge.

Méndez-Toribio, M., Martínez-Garza, C., Ceccon, E. & Guariguata, M.R. 2018. *La restauración de ecosistemas terrestres en México: Estado actual, necesidades y oportunidades.* Documentos Ocasionales 185. Bogor, Indonesia. CIFOR. www.cifor.org/publications/pdf_files/OccPapers/OP-185.pdf

Merino Pérez, L. & Martínez Romero, A.E. 2014. *A vuelo de pájaro. Las condiciones de las comunidades con bosques templados en México*. México: CONABIO. www.biodiversidad.gob.mx/publicaciones/versiones_digitales/Vuelo_Pajaro.pdf (Accessed on 12/05/2021).

Merino-Perez, L. & Segura-Warnholtz, G. 2005. Forest and conservation policies and their impact on forest communities in Mexico. pp. 49–70. In: D.B. Bray, L. Merino-Perez & D. Barry, eds. *The community forests of Mexico. Managing for sustainable landscapes*. The Univ. of Texas Press, Austin, TX.

Merino, L., Rodríguez, J., Ortiz, G. & García A. 2008. *Estudio estratégico sobre el sector forestal mexicano*. México:CCMSS. https://vtechworks.lib.vt.edu/bitstream/handle/10919/67505/3400_mexican_forest_sector_study_4_08_spanish.pdf?sequence=1&isAllowed=y (Accessed on 12-05-2021)

Miles, L., Newton, A.C., Defries, R.S., Ravilious, C., May, I., Blyth, S., Kapos, V. & Gordon, J.E. 2006. A global overview of the conservation status of tropical dry forests. *Journal of Biogeography*, 33(3): 491–505. https://doi.org/10.1111/j.1365-2699.2005.01424.x

MINAGRI. 2015. Política Nacional Forestal y de Fauna Silvestre. 2da. edición. Lima, Perú. 140 pp.

MINAM. 2010. Política Nacional del Ambiente. Ministerio del Ambiente. Lima, Perú. https://doi.org/10.31381/paideia.v2i3.462

MINAM. 2014a. Especies de Fauna Silvestre Peruana en los apéndices de la CITES. Ministerio del Ambiente. Lima, Perú. www.minam.gob.pe/diversidadbiologica/wp-content/uploads/sites/21/2014/02/Especies-de-Fauna-Silvestre-Peruana-en-los-Apéndices-de-la-CITES1.pdf

MINAM. 2014b. Estrategia Nacional ante el Cambio Climático. Ministerio del Ambiente. Lima, Perú. www.minam.gob.pe/wp-content/uploads/2014/07/Estrategia-Nacional-ante-el-Cambio-Climatico_ENCC.pdf

MINAM. 2014c. Estrategia Nacional de Diversidad Biológica al 2021. Plan de Acción 2014–2018. Lima, Peru: Ministerio del Ambiente. https://sinia.minam.gob.pe/documentos/estrategia-nacional-diversidad-biologica-2021-plan-accion-2014-2018

MINAM. 2016a. *Estrategia Nacional sobre Bosques y Cambio Climático*. Lima, Perú: Ministerio del Ambiente. www.bosques.gob.pe/archivo/ff3f54_ESTRATEGIACAMBIOCLIMATICO2016_ok.pdf

MINAM. 2016b. *La Contribución Nacional del Perú - iNDC: agenda para un desarrollo climáticamente responsable*. Lima, Perú: Ministerio del Ambiente. https://cdn.www.gob.pe/uploads/document/file/374111/LA-CONTRIBUCIÓN-NACIONAL-DEL-PERÚ11.pdf

MINAM. 2018. Grupo de Trabajo Multisectorial de naturaleza temporal encargado de generar información técnica para orientar la implementación de las Contribuciones Nacionalmente Determinadas (GTM-NDC). Lima, Perú. 921 p. www.minam.gob.pe/cambioclimatico/wp-content/uploads/sites/127/2019/01/190107_Informe-final-GTM-NDC_v17dic18.pdfPAÑOL.pdf

MINAM. 2021. *Estrategia de Intervención del Programa Nacional de Conservación de Bosques para la Mitigación del Cambio Climático al 2030*. Lima, Perú: Ministerio del Ambiente. www.bosques.gob.pe/archivo/Estrategia-de-Intervencion-al-2030.pdf.

Ministry of Energy and Natural Resources. 2021. *Malaysia Policy on Forestry*. www.mybis.gov.my/pb/4825

Ministry of Natural Resources and Environment (Malaysia). 2016. National Policy on Biological Diversity 2016–2025. 110 pp. www.cbd.int/doc/world/my/my-nbsap-v2-en.pdf

Ministry of the Environment (Finland). 2013. *Saving Nature for People. National action plan for the conservation and sustainable use of biodiversity in Finland 2013-2020*. 105 pp. https://ym.fi/documents/1410903/38439968/National_action_plan2013_SavingNatureforPeople-EA60AA4E_861F_414D_9EFE_E8B967313381-96885.pdf/3fd101e9-6a12-91f8-211c-a2ab1d32794b/National_action_plan2013_SavingNatureforPeople-EA60AA4E_861F_414D_9EFE_E8B967313381-96885.pdf?t=1603260663505

Ministry of the Environment (Finland). 2021a. Everyman´s rights in Finland. www.ymparisto.fi/en-US, Retrieved April 2021.

Ministry of the Environment (Finland). 2021b. Responsibility areas (translated).

Ministry of the Environment (Finland). 2022. Nature conservation areas. https://ym.fi/en/nature-conservation-areas. Retrieved April 2022.

Ministry of the Environment. 2020. Environmental statistics 2019 (In Japanese). www.rinya.maff.go.jp/j/kikaku/hakusyo/r1hakusyo_csv/all/index.html

Ministry of the Environment. 2021a. JBO3. Japan Biodiversity Outlook 3. 2021 Report of Comprehensive Assessment of Biodiversity and Ecosystem Services in Japan. Summary for Policymakers. 47 pp. www.biodic.go.jp/biodiversity/activity/policy/jbo3/generaloutline/files/JBO3_pamph_en.pdf

Ministry of the Environment. 2021b. Sato-navi (In Japanese). www.env.go.jp/nature/satoyama/satonavi/

Ministry of Natural Resources and Environment. 2016. *National Policy on Biological Diversity 2016–2025*. Ministry of Natural Resources and Environment, Malaysia. 111 pp. www.cbd.int/doc/world/my/my-nbsap-v2-en.pdf

Misni, A., Rasam, A.R.A. & Buyadi, S.N.A. 2017. Spatial analysis of habitat conservation for hornbills: A case study of Royal Belum-Temengor forest complex in Perak State Park, Malaysia. *Pertanika Journal of Social Science and Humanities*, 25: 11–20.

Montoya Gandarillas, S.A. 2019. Participación comunitaria para la conservación del bosque húmedo de montaña. *In:* H. Reyes Hernández, A. Durán Fernández & F.J. Sahagún Sánchez, eds. *Biodiversidad y conservación de ecosistemas de la Región Prioritaria para la Conservación Xilitla*. México: Universidad Autónoma de San Luis Potosí. www.researchgate.net/publication/337745117_Biodiversidad_y_conservacion_de_ecosistemas_de_la_Region_Prioritaria_para_la_Conservacion_Xilitla

Morett-Sánchez, J.C. & Cosío-Ruiz, C. 2017. Outlook of ejidos and agrarian communities in México. *Agricultura, Sociedad y Desarrollo*, 14(1): 125–152. www.scielo.org.mx/pdf/asd/v14n1/1870-5472-asd-14-01-00125-en.pdf

Mori Dukuri Forum. 2021. Information on funds and grants for forest management activities by citizens (In Japanese). www.moridukuri.jp/moridukuri/mori_jyosei_info.html

Mori-navi Management Office. 2021. Kigyo-no-Mori (in Japanese). www.morinavi.com/support/support-tokyo.html

Narita, D., Lemenih, M., Shimoda, Y. & Ayana, A.N. 2018. Economic accounting of Ethiopian forests: A natural capital approach. *Forest Policy and Economics*, 97: 189-200. https://doi.org/10.1016/j.forpol.2018.10.002

Nasi, R., Taber, A. & Vliet, N.V. 2011. Empty forests, empty stomachs? Bushmeat and livelihoods in the Congo and Amazon Basins. *International Forestry Review*, 13(3): 355–368.

Nasir, M.M., Richard, A., Akhirrudin, M., Endot, S. & Latiff, A. 2017. New Discovery of *Shorea kuantanensis* Ashton (Dipterocarpaceae) in Peninsular Malaysia. *The Malaysian Forester*, 80(2): 125–128.

National Strategy for Community Forestry in the Democratic Republic of Congo. 2018. (Available at: www.rainforestfoundationuk.org/media.ashx/a-national-strategy-for-community-forestry-2018.pdf)

OECD/ECLAC. 2017. *OECD Environmental Performance Reviews: Peru 2017*. Organisation for Economic Co-operation and Development/ Economic

Commission for Latin America and the Caribbean. Paris: OECD Publishing. dx.doi.org/10.1787/9789264283138-en www.oecd-ilibrary.org/environment/oecd-environmental-performance-reviews-peru_9789264283138-en

Ogden, R., Fukuda, T., Funo, T., Komatsu, M., Maeda, T., Meredith, A., Miura, M. *et al.* 2020. Japanese golden eagle conservation science: Current status and future needs. *Japanese Journal of Zoo and Wildlife Medicine,* 25(1): 9–28.

Ogura, J. 2012. History of Forests and Grasslands. Tokyo: Kokon Shoin (In Japanese).

Olivo Escudero, J.C. 2016. La protección de la biodiversidad en el derecho ambiental mexicano: un análisis de la legislación desde el enfoque de especies amenazadas y su hábitat crítico. *Boletín Mexicano de Derecho Comparado*, 49(147): 347–371. www.scielo.org.mx/pdf/bmdc/v49n147/2448-4873-bmdc-49-147-00347.pdf

Olson, D.M. & Dinerstein, E. 1998. The Global 200: A representation approach to conserving the earth's most biologically valuable ecoregions. *Conservation Biology*, 12(3): 502–515. https://doi.org/10.1046/j.1523-1739.1998.012003502.x

Pautrat, L., Torres, P. & Samaniego, K. 2010. Sobre la institucionalidad forestal en el Perú. Lima, Perú: Sociedad Peruana de Ecodesarrollo. 31 pp.

Paz Pellat, F., Romero Benitez, V.M., Argumendo Espinoza, J., Bolaños-González, M.A., de Jong, B.H.J., Cruz-Cabrera, J. & Velázquez-Rodríguez, A. 2019. Dinámica del suelo y la vegetación. Carbon dynamics in tropical secondary forests. *Ecosistemas Terrestres*. www.researchgate.net/publication/333907848_Capitulo_23_DINAMICA_DEL_USO_DEL_SUELO_Y_VEGETACION (Accessed on 12/05/2021)

Pepper, S., Barbour, A. & Glass, J. 2020. *The Management of Wild Deer in Scotland: Report of the Deer Working Group*. Scottish Government, Environment and Forestry Directorate. https://pure.sruc.ac.uk/ws/files/20036952/Final_published_DWG_report_2020.pdf

PEBLDS. 1995. Pan-European Biological and Landscape Diversity Strategy (PEBLDS), Text Transmitted to the UN-ECE Working Group of Senior Governmental Officials `Environment for Europe', by the steering committee for the protection and management of the environment and natural habitats (CDPE) of the Council of Europe, Strassbourg, 30 pp. www.cbd.int/doc/nbsap/rbsap/peblds-rbsap.pdf

Programme National Environnement, Forêts, Eaux et Biodiversité (PNEFEB). 2013. 2ème Génération. December 2013, Ministère de l'Environnement, Conservation de la Nature et Tourisme, Kinshasa, DRC.

Quine, C.P., Humphrey, J.W. & Watts, K. 2003. Biodiversity in the UK's Forests – recent policy developments and future research challenges. In: F. Andersson, Y. Birot & R. Päivinen, eds. *EFI Proceedings: Towards the Sustainable Use of Europe's Forests – Forest Ecosystem and Landscape Research: Scientific Challenges and Opportunities*. pp. 237–249.

Radu, A. 2019. The Orang Asli: Fighting for ancestral land in Malaysia. *The Diplomat*, August 13 2019. https://thediplomat.com/2019/08/the-orang-asli-fighting-for-ancestral-land-in-malaysia/

RAISG. 2015. Deforestation in the Amazonia (1970–2013). 48 pp. www.raisg.socioambiental.org

Rakuten. 2015. "Rakuten's forest" reforestation initiative to be expanded nationwide. https://global.rakuten.com/corp/news/press/2015/0416_01.html

Ramírez-Bamonde, E., Sánchez-Velásquez, L.R. & Andrade-Torres, A. 2005. Seedling survival and growth of three species of mountain cloud forest in Mexico, under different canopy treatments. *New Forests,* 30: 95–101. www.researchgate.net/publication/227287295_Seedling_survival_and_growth_of_three_species_of_mountain_cloud_forest_in_Mexico_under_different_canopy_treatments (Accessed on 13/05/2021).

Ramírez Palomeque, T.L., Alfaro Medina, C.S., Fortanelli Martínez, J. & De Nova Vázquez, J.A. 2019. Biodiversidad, conservación y aprovechamiento de orquídeas, *In:* H. Reyes Hernández, A. Durán Fernández & F.J. Sahagún Sánchez, eds. *Biodiversidad y conservación de ecosistemas de la Región Prioritaria para la Conservación Xilitla*. México: Universidad Autónoma de San Luis Potosí. www.researchgate.net/profile/Francisco-Sahagun-Sanchez/publication/337745117_Biodiversidad_y_conservacion_de_ecosistemas_de_la_Region_Prioritaria_para_la_Conservacion_Xilitla/links/5de8046aa6fdcc2837066e36/Biodiversidad-y-conservacion-de-ecosistemas-de-la-Region-Prioritaria-para-la-Conservacion-Xilitla.pdf (Accessed on 13/05/2021).

Raši, R., ed. 2020. FOREST EUROPE, 2020: State of Europe's Forests 2020. Ministerial Conference on the Protection of Forests in Europe – FOREST EUROPE Liaison Unit Bratislava. https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf

Reátegui, E. & Valencia, W. 2008. Plan de negocio del Comité de Gestión de Bosque de la cuenca del río Momón. Iquitos: CGBCRM. IIAP, Proyecto Focal Bosques. 88 pp. https://repositorio.iiap.gob.pe/bitstream/20.500.12921/272/1/reategui_documentotecnico_2008.pdf

Rees, J.D. 1970. Paricutin revisited: A review of man's attempts to adapt to ecological changes resulting from volcanic catastrophe. *Geoforum* 1(4): 7–25. https://doi.org/10.1016/0016-7185(70)90055-2 (Accessed on 13/05/2021).

Reforestamos Mexico. 2019. Central-Western Biocultural Corridor of Mexico Annual Report, Mexico. https://235cfbc8-607b-4eba-9b06-8bee0582d82a.filesusr.com/ugd/b1748a_89c945a800cb4d35b17a9cdd5f0ba904.pdf (Accessed on 13/05/2021).

Reforestamos Mexico. 2020a. Boscares. https://235cfbc8-607b-4eba-9b06-8bee0582d82a.filesusr.com/ugd/b1748a_86656ee71e0d4e5d9289ce8bae495dc4.pdf (Accessed on 12/05/2021).

Reforestamos Mexico. 2020b. Mejores Alianzas, Mejores Bosques y los Objetivos de Desarrollo Sostenible. Reforestamos México. www.reforestamosmexico.org/post/mejores-alianzas-mejores-bosques-y-los-objetivos-de-desarrollo-sostenible (Accessed on 13-05-2021).

Rehfeldt, G.E., Crookston, N.L., Sáenz-Romero, C. & Campbell, E.M. 2012. North American vegetation model for land-use planning in a changing climate: A solution to large classification problems. *Ecological Applications,* 22: 119–141. www.researchgate.net/publication/223983656_North_American_vegetation_model_for_land-use_planning_in_a_changing_climate_A_solution_to_large_classification_problems (Accessed on 12/05/2021).

Reichhuber, A. & Requate, T. 2007. *Alternative use systems for the remaining cloud forest in Ethiopia and the role of Arabica coffee – A cost-benefit analysis*. Economics Working Paper, No. 2007-07, Kiel University, Department of Economics, Kiel. www.econstor.eu/handle/10419/22023

RFUK. 2014a. Community forests in the Democratic Republic of the Congo. www.rainforestfoundationuk.org/media/82d2622e-2145-49bd-a71c-901c97209f1d

RFUK. 2014b. Rethinking community based forest management in the Congo basin. November 2014. www.rainforestfoundationuk.org/media.ashx/rethinkingcommunitybasedforestmanagementinthecongobasinnovember2014.pdf

Román, F., Mamani, A., Cruz, A., Sandoval, C. & Cuesta, F. 2018. *Orientaciones para la restauración de ecosistemas forestales y otros ecosistemas de vegetación silvestre*. Lima, Peru: Servicio Nacional Forestal y de Fauna Silvestre (SERFOR). 108 pp. www.serfor.gob.pe/portal/wp-content/uploads/2019/01/Orientaciones-para-la-restauraci%C3%B3n-de-ecosistemas-forestales.pdf

Sabogal, C. & Casaza, J., compilers. 2010. *Standing tall: Exemplary cases of sustainable forest management in Latin America and the Caribbean*. Rome: FAO. 273p. www.fao.org/3/br099e/br099e.pdf

Sado City. 2021. Certificated rice "Toki to Kurasu Sato" (in Japanese). www.city.sado.niigata.jp/site/sato/1165.html

Saksa,T., ed. 2020. Ilmastonmuutos ja metsänhoito: Yhteenveto ilmastonmuutoksen vaikutuksista metsänhoitoon. Climate change and forest management. Summary on the impact of climate change on forest management. (Translated). Luonnonvara- ja biotalouden tutkimus 98/2020. Luonnonvarakeskus. https://jukuri.luke.fi/bitstream/handle/10024/546573/luke-luobio_98_2020.pdf?sequence=1&isAllowed=y

Sánchez-Velásquez, L.R. & García-Moya E. 1993. Sucesión Forestal en la Sierra de Manantlán Jal., México: Bosque mesófilo de montaña y bosque de Pinus. *Agrociencia* 3(1): 7–26. www.researchgate.net/publication/259558802_SUCESION_FORESTAL_EN_LOS_BOSQUES_MESOFILO_DE_MONTANA_Y_DE_Pinus_DE_LA_SIERRA_DE_MANANTLAN_JALISCO_MEXICO (Accessed on 13/05/2021).

Sánchez-Velásquez, L.R., Quintero-Gradilla, S., Aragón-Cruz, F. & Pineda-López, Ma. del R. 2004. Nurses for *Brosimum alicastrum* reintroduction in secondary tropical dry forest. *Forest Ecology and Management*. 198: 401404. www.researchgate.net/publication/222242081_Nurses_for_Brosimum_alicastrum_reintroduction_in_secondary_tropical_dry_forest (Accessed on 13/05/2021).

Sarkki, S., Niemelä, J., Tinch, R., Jäppinen, J.P., Nummelin, M., Toivonen, H. & Von Weissenberg, M. 2016. Are national biodiversity strategies and action plans appropriate for building responsibilities for mainstreaming biodiversity across policy sectors? The case of Finland. *Journal of Environmental Planning and Management*, 59(8): 1377–1396.

Sarukhán, J., Carabias, J., Koleff, P. & Urquiza-Haas, T. 2012. Capital Natural de México: Acciones estratégicas para su valoración, preservación y recuperación. Mexico City, México: CONABIO. https://bioteca.biodiversidad.gob.mx/janium/Documentos/14959.pdf (Accessed on 12/05/2021)

Sarukhán, J., Koleff, P., Carabias, J., Soberón, J., Dirzo, R., Llorente-Bousquets, J., Halffter, G., González, R., March, I., Mohar, A., Anta, S. & de la Maza, J. 2009. *Capital natural de México. Síntesis: conocimiento actual, evaluación y perspectivas de sustentabilidad*. México: CONABIO. https://bioteca.biodiversidad.gob.mx/janium/Documentos/6362.pdf (Accessed on 12/05/2021)

Saw, L. & Chung, R. 2007. Towards the flora of Malaysia. In: L.S.L. Chua, L.G. Kirton & L.G. Saw, eds. *Status of biological diversity in Malaysia and threat assessment of plant species in Malaysia*. Proceedings of the seminar and workshop, 28–30 June 2005. Forest Research Institute Malaysia, Kepong, Malaysia. pp. 203–219. www.mybis.gov.my/pb/96

Saw, L.G., Chua, L.S.L. & Rahim, N.A., eds. 2009. *Malaysia National Strategy for Plant Conservation*. Ministry of Natural Resources and Environment and Forest Research Institute Malaysia (FRIM), Malaysia. 61 pp. www.mybis.gov.my/pb/26

Saw, L.G., Chua, L.S.L., Suhaida, M., Yong, W.S.Y. & Hamidah, M. 2010. Conservation of some rare and endangered plants from Peninsula Malaysia. *Kew Bulletin*, 65(4): 681–689.

Scottish Executive. 2004. *Scotland's biodiversity: it's in your hands*. A strategy for the conservation and enhancement of biodiversity in Scotland. doi:0755941209. www.gov.scot/publications/scotlands-biodiversity---its-in-your-hands/

Scottish Government. 2011. *Getting the best from our land: A land use strategy for Scotland*. The Scottish Government. 48 pp. www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2011/03/getting-best-land-land-use-strategy-scotland/documents/0115155-pdf/0115155-pdf/govscot%3Adocument/0115155.pdf

Scottish Government. 2016. *Getting the best from our land: A land use strategy for Scotland 2016–2021*. The Scottish Government. 43 pp. www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2016/03/getting-best-land-land-use-strategy-scotland-2016-2021/documents/00497086-pdf/00497086-pdf/govscot%3Adocument/00497086.pdf?forceDownload=true

Scottish Government. 2019. *Scotland´s Forestry Strategy 2019–2029*. Scottish Government. 50 pp. https://forestry.gov.scot/component/edocman/373-scotland-s-forestry-strategy-2019-2029/download?Itemid=0

Scottish Government. 2020. *Scottish biodiversity strategy post-2020: a statement of intent*. Scottish Govenment. 21 pp. https://www.gov.scot/publications/scottish-biodiversity-strategy-post-2020-statement-intent/

Scottish Government. 2021a. Scottish Rural Development Programme. www.ruralpayments.org/publicsite/futures/topics/customer-services/common-agricultural-policy/scottish-rural-development-programme/

Scottish Government. 2021b. *Scotland's third land use strategy 2021–2026: Getting the best from our land*. Scottish Government. 47 pp. http://extwprlegs1.fao.org/docs/pdf/uk206925.pdf

Scottish Government. 2022. Wildlife crime in Scotland: 2020 annual report. www.gov.scot/publications/wildlife-crime-scotland-2020-annual-report/

Scottish Natural Heritage. 2011. Code of practice on deer management. Scottish Natural Heritage leaflet. Scottish Natural Heritage, Inverness. www.nature.scot/doc/code-practice-deer-management-leaflet

Scottish Natural Heritage. 2016. *Deer management in Scotland: report to the Scottish Government from Scottish Natural Heritage 2016*. https://sp-bpr-en-prod-cdnep.azureedge.net/published/ECCLR/2017/4/3/Report-on-Deer-Management-in-Scotland--Report-to-the-Scottish-Government-from-Scottish-Natural-Heritage-2016/5th%20Report.pdf

Scottish Parliament. 2003. Land Reform (Scotland) Act 2003. www.legislation.gov.uk/asp/2003/2

Scottish Parliament. 2004. Nature Conservation (Scotland) Act. www.legislation.gov.uk/asp/2004/6/

Scottish Parliament. 2009. Climate change (Scotland) Act 2009. Scottish Government. www.legislation.gov.uk/asp/2009/12/

Scottish Parliament. 2011. Wildlife and Natural Environment (Scotland) Act. www.legislation.gov.uk/asp/2011/6/

Scottish Parliament. 2015. Community Empowerment (Scotland) Act 2015. Scottish Government. www.legislation.gov.uk/asp/2015/6/contents/enacted

Scottish Parliament. 2016. Land Reform (Scotland) Act 2016. Scottish Government. www.legislation.gov.uk/asp/2016/18

Scottish Parliament. 2019. Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. www.legislation.gov.uk/asp/2019/15/

SEMARNAT. 2020a. Programa Nacional Forestal 2020–2024. www.dof.gob.mx/nota_detalle.php?codigo=5609275&fecha=31/12/2020 (accessed 12 May 2021)

SEMARNAT. 2021b. Trámites relacionados al tema de forestal y suelos: autorizaciones y permisos en materia de recursos forestales y suelos. www.gob.mx/semarnat/acciones-y-programas/tramites-relacionados-al-tema-de-forestal-y-suelos (Accessed on 8/05/2021).

SERFOR. 2015. Ley Forestal y de Fauna Silvestre No. 29763 y sus Reglamentos. Bosques productivos para la vida. Ministerio de Agricultura y Riego (MINAGRI). Lima, Perú: Servicio Nacional Forestal y de Fauna Silvestre (SERFOR). 345 pp. www.serfor.gob.pe/portal/wp-content/uploads/2016/03/LFFS-Y-SUS-REGLAMENTOS.pdf

SERFOR. 2017. *Estrategia Nacional para Reducir el Tráfico Ilegal de Fauna Silvestre en el Perú 2017–2027 y su Plan de Acción 2017–2022*. Lima, Perú: Servicio Nacional Forestal y de Fauna Silvestre. 72 pp. www.serfor.gob.pe/portal/wp-content/uploads/2017/09/PRESENTACION-DE-LA-ESTRATEGIA-NACIONAL-PARA-REDUCIR-EL-TRAFICO-ILEGAL-DE-FAUNA-SILVESTRE.pdf

SERFOR. 2018. Lineamientos para la Restauración de Ecosistemas Forestales y otros Ecosistemas de Vegetación Silvestre. Lima, Perú: Servicio Nacional Forestal y de Fauna Silvestre. 44 pp. www.serfor.gob.pe/portal/wp-content/uploads/2018/11/15.05-Lineamientos-restauracion-BAJA.pdf

SERFOR, Bioversity - Perú & ICRAF. 2018. *Experiencias de restauración en el Perú. Lecciones aprendidas*. Lima, Perú. 132 pp. www.serfor.gob.pe/portal/wp-content/uploads/2019/01/Experiencias-de-Restauraci%C3%B3n-en-el-Per%C3%BA-Lecciones-aprendidas.pdf

Siitonen, J., Punttila, P., Korhonen, K.T., Heikkinen, J., Laitinen, J., Partanen, J., Pasanen, H. & Saaristo, L. 2020. Development of nature management in commercial forests 1995-2018 according to nature quality survey and the results of national

forest inventory (translated). Research on Natural Resources and Bioeconomy. 69/2020. Natural Resources Institute Finland. https://jukuri.luke.fi/bitstream/handle/10024/546354/luke_luobio_69_2020.pdf?sequence=1

Sisay, T., Alemu, A. & Mariam, Y.G. 2020. Quality of tree seedlings across different nursery ownerships in Central Gondar Zone, Ethiopia. *Journal of Horticulture and Forestry*, 12(3): 84–93.

SNFC. 2018. *Une stratégie nationale pour la foresterie communitaire en RDC*. Briefing Mars 2018. Rainforest Foundation UK. 12 pp. https://loggingoff.info/wp-content/uploads/2018/07/une-strategie-nationale-pour-la-foresterie-communautaire-2018.pdf

Spake, R., Yanou, S., Yamaura, Y., Kawamura, K., Kitayama, K. & Doncaster, C.P. 2019. Meta-analysis of management effects on biodiversity in plantation and secondary forests of Japan. *Conservation Science and Practice,* 1: 14.

Stagg, R. 2021. Chapter 1: Woodland Area & Planting, Forestry Statistics 2021. Forest Research. pp. 1–60 www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2021/

Sugiura, K. & Oki, Y. 2018. Reasons for choosing Forest Stewardship Council (FSC) and Sustainable Green Ecosystem Council (SGEC) schemes and the effects of certification acquisition by forestry enterprises in Japan. *Forests*, 9: 10.3390/f9040173. www.mdpi.com/1999-4907/9/4/173

Symington, C.F. 2004. *Foresters' Manual of Dipterocarps*. P.S. Ashton & S. Appanah, revised; H.S. Barlow, ed. Forest Research Institute Malaysia: Kuala Lumpur, Malaysia.

Tadesse, W., Worku, A. & Kang, H.S., eds. 2020. *Regreening Ethiopia*. Daejeon, Republic of Korea: Korea Forest Service. 347 pp.

Takahashi, T. & Tanaka, K. 2021. Models explaining the levels of forest environmental taxes and other PES schemes in Japan. *Forests,* 12: 685. https://doi.org/10.3390/f12060685

Takeuchi, K., Ichikawa, K. & Elmqvist, T. 2016. Satoyama landscape as social–ecological system: historical changes and future perspective. *Current Opinion in Environmental Sustainability,* 19: 30–39.

Taki, H., Inoue, T., Tanaka, H., Makihara, H., Sueyoshi, M., Isono, M. & Okabe, K. 2010. Responses of community structure, diversity, and abundance of understory plants and insect assemblages to thinning in plantations. *Forest Ecology and Management*, 259(3): 607–613.

Tapio Ltd. 2021. *Protecting endangered species in forestry. Lajiturva Project*. 30.6.21. Tapio publication (translated from Finnish). 36 pp. https://tapio.fi/wp-content/uploads/2021/08/Lajiturva_opas_2021.pdf

Thomas, H.J.D., Paterson, J.S., Metzger, M. & Sing, L. 2015. Towards a research agenda for woodland expansion in Scotland. *Forest Ecology and Management*, 349: 149–161.

Toledo Aceves, T. & Porter Bolland, L. 2019. Manejo de uso múltiple de bosques tropicales. Ciencia y Desarollo. Mexico City, Mexico: CONACYT. www.cyd.conacyt.gob.mx/?p=articulo&id=229 (Accessed 12/05/2021).

Torres-Rojo, J.M. 2004. Estudio y perspectivas del sector forestal en América Latina. Documento de trabajo. Informe Nacional Mexico: FAO Working paper. www.fao.org/3/j2215s/j2215s00.htm

Torres-Rojo, J.M. 2015. Características de los núcleos agrarios forestales en México, in *Desarrollo Forestal Comunitario: La Política Pública* pp.15–38. Mexico: CIDE. www.researchgate.net/publication/308139738_Caracteristicas_de_los_nucleos_agrarios_forestales_en_Mexico_In_Desarrollo_Forestal_Comunitario (Accessed on 11/05/2021).

Torres-Rojo, J.M., Moreno-Sánchez, R. & Mendoza-Briseño, M.A. 2016. Sustainable forest management in Mexico. *Current Forestry Reports,* 2: 93–105. https://doi.org/10.1007/s40725-016-0033-0 (Accessed on 12/05/2021).

Toyooka City. 2019. Rice nurturing stork (in Japanese). www.city.toyooka.lg.jp/konotori/nosanbutsu/1004053.html

Turunen, M.T., Rasmus, S., Järvenpää, J. & Kivinen, S. 2020. Relations between forestry and reindeer husbandry in northern Finland – Perspectives of science and practice. *Forest Ecology and Management*, 457: 117677. https://projects.luke.fi/busk/wp-content/uploads/sites/15/2020/02/Turunen_et_al.__29052019_Impacts-of-forestry-on-reindeer-herding_manuscript.pdf

UK Government. 1981. Wildlife and Countryside Act. www.legislation.gov.uk/ukpga/1981/69

UK Government. 2021. Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations. www.legislation.gov.uk

UNEP-WCMC. 2014. WDPA Global Statistics. August 2014. Available at: www.unep-wcmc.org/resources-and-data/wdpa

UNODC. 2006. United Nations Office of Drug Control. The environmental effects of illicit drug cultivation and processing. *Coca cultivation in the Andean region for 2005*. pp.19–46. www.unodc.org/pdf/andean/Andean_report_Part2.pdf

Vaahtera, E. 2021. Forest resources in Finland. https://stat.luke.fi/en/forest-resources. Retrieved April 2021

Valluri-Nitsch, C., Metzger, M.J., McMorran, R. & Price, M. 2018. My land? Your land? Scotland? Understanding sectoral similarities and differences in Scottish land use visions. *Regional Environmental Change*, 18(3): 803–816. https://link.springer.com/content/pdf/10.1007/s10113-018-1279-9.pdf

Vaz, J. & Lim, T.W. 2012. Realising our shared vision for the Kota Damansara Forest Reserve, Selangor. In Prosiding ekspedisi saintifik kepelbagaian biology- Hutan Simpan Kota Damansara, Selangor (pp. 176–183). Selangor State Forestry Department.

Velázquez, A., Bocco, G., Torres, A., Chavez Lopez, A. & Aguilar Gómez, F. 2015. Indigenous Community of Nuevo San Juan Parangaricutiro, Michoacán, Mexico. In: J.P. Siry, P. Bettinger, K. Merry, D.L. Grebner, K. Boston & C. Cieszewski, eds. *Forest Plans of North America*. Elsevier, New York. www.researchgate.net/publication/282327389_The_Indigenous_Community_of_Nuevo_San_Juan_Parangaricutiro_Michoacan_Mexico (Accessed on 23/05/2021).

Villaseñor, J.L. & Ortiz, E. 2014. Biodiversidad de las plantas con flores (División Magnoliophyta) en México. *Revista Mexicana de Biodiversidad*, 85: S134–S142. www.scielo.org.mx/pdf/rmbiodiv/v85sene/v85senea16.pdf

Voluntary National Review. 2020. Finland. Report on the implementation of the 2030 agenda for sustainable development. Publications of the Prime Minister´s Office. 2020:

8. https://sustainabledevelopment.un.org/content/documents/26261VNR_Report_Finland_2020.pdf

Watanabe, T., Okuyama, M. & Fukamachi, K. 2012. A review of Japan's environmental policies for Satoyama and Satoumi landscape restoration. *Global Environmental Research*, 16(2): 125–135.

West, P., Igoe, J. & Brockington, D. 2006. Parks and peoples: the social impact of protected areas. *Annual Review of Anthropology*, 35: 251–277. www.iheal.univ-paris3.fr/sites/www.iheal.univ-paris3.fr/files/parks%40poples%20annurev%252Eanthro%252E35%252E081705%252E123308.pdf

Wong, J., Lawrence, A., Urquhart, J., Feliciano, D. & Slee, B. 2015. *Forest Land Ownership Change in United Kingdom*. COST Action FP1201 FACESMAP Country Report. European Forest Institute Central-East and South-East European Regional Office, Vienna. 72 pp. https://aura.abdn.ac.uk/bitstream/handle/2164/4750/FP1201_Country_Report_UNITED_KINGDOM.pdf?sequence=1

Wook, I. 2015. *The rights of the Orang Asli in forests in Peninsular Malaysia: Towards justice and equality* (Doctoral dissertation, Victoria University).https://vuir.vu.edu.au/33650/1/WOOK%20Izawati%20-%20Thesis.pdf

Wyn, L.T. 2013. Malaysia: illegalities in forest clearance for large-scale commercial plantations. Forest Trends. www.forest-trends.org/wp-content/uploads/imported/for155-malaysia-white-paper-letter-14-0121-hr-pdf.pdf

Yalle, S. & McBreen, J. 2018. *Experiencias de la restauración del paisaje forestal con aplicación de ROAM en Perú*. Quito, Ecuador: UICN-América del Sur. 30 pp. www.iucn.org/sites/dev/files/content/documents/flr_peru_experiencias_roam.pdf

Yang, A. 2020. *The Multiple Roles of Scottish Woodlands*. Scottish Parliament. Public Information & Publications. SB 20-58. https://sp-bpr-en-prod-cdnep.azureedge.net/published/2020/9/9/The-Multiple-Roles-of-Scottish-Woodlands-1/SB 20-58.pdf

Yong, W.S.Y., Chua, L.S.L., Lau, K.H., Siti-Nur Fatinah, K., Cheah, Y.H., Yao, T.L., Rafidah, A.R. *et al.* 2021. *Malaysia Red List: Plants of Peninsular Malaysia*. Vol. 1, Part I & II. Research Pamphlet No. 151. Forest Research Institute Malaysia, Kepong. www.frim.gov.my/publication/other-publications/malaysia-red-list/

Yusuhara Town. 2017. Promotion to use timbers produced in the town and for constructions and biomass energy (in Japanese). www.town.yusuhara.kochi.jp/town/environment/torikumi/energy.html

zu Ermgassen, S.O.S.E., Utamiputri, P., Bennun, L., Edwards, S. & Bull, J.W. 2019. The role of "no net loss" policies in conserving biodiversity threatened by the global infrastructure boom. *One Earth*, 1(3): 305–315. www.sciencedirect.com/science/article/pii/S2590332219301332

188
FAO FORESTRY PAPER

Mainstreaming biodiversity in forestry

Forests harbour a large proportion of the Earth's terrestrial biodiversity, which continues to be lost at an alarming rate. Deforestation is the single most important driver of forest biodiversity loss with 10 million ha of forest converted every year to other land uses, primarily for agriculture. Up to 30 percent of tree species are now threatened with extinction. As a consequence of overexploitation, wildlife populations have also been depleted across vast areas of forest, threatening the survival of many species. Protected areas, which are considered the cornerstone of biodiversity conservation, cover 18 percent of the world's forests while a much larger 30 percent is designated primarily for the production of timber and non-wood forest products. These and other forests managed for various productive benefits play a critical role in biodiversity conservation and also provide essential ecosystem services, such as securing water supplies, providing recreational space, underpinning human well-being, ameliorating local climate and mitigating climate change. Therefore, the sustainable management of all forests is crucial for biodiversity conservation, and nations have committed to biodiversity mainstreaming under the Convention on Biological Diversity (CBD). Mainstreaming biodiversity in forestry requires prioritizing forest policies, plans, programmes, projects and investments that have a positive impact on biodiversity at the ecosystem, species and genetic levels. In practical terms, this involves the integration of biodiversity concerns into everyday forest management practice, as well as in long-term forest management plans, at various scales. It is a search for optimal outcomes across social, economic and environmental dimensions of sustainable development. This study is a collaboration between FAO and the Center for International Forestry Research (CIFOR), lead centre of the CGIAR research programme on Forests, Trees and Agroforestry (FTA). Illustrated by eight country case studies, the report reviews progress and outlines the technical and policy tools available for countries and stakeholders, as well as the steps needed, to effectively mainstream biodiversity in forestry.

ISBN 978-92-5-136937-1 ISSN 0258-6150

9 789251 369371

CC2229EN/1/10.22